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CENTRAL-STATION AND RAILWAY POWER COSTS.

Analysis of the cost of manufacturing electricity in a large number of electric-railway and lighting plants in the same territory recently disclosed the fact that in almost every case the railway stations produced power at a lower operating expense per kilowatt-hour than was obtained in the central-station installations. In almost all the lighting plants the cost varied from a little over one cent to two or 2.5 cents per kilowatt-hour, while in the railway stations examined the cost was frequently less than one cent per unit. Of course, comparisons of energy cost are of little value unless the conditions surrounding production are cited, but the general gain in efficiency exhibited by railway plants, contrasted with lighting stations in the same region of the country, merits special consideration of the cause.

The average electric-railway plant is a simple direct-current installation throughout, free from complications on the electrical side, and requiring a minimum force of engine-room attendants for its regular service. There are few pieces of auxiliary electrical equipment in such stations, and the energy losses between the generators and the outgoing lines are almost always very low. The machinery lends itself to parallel operation with so much ease that there is no incentive to keep generating units in service longer than economical loads dictate, and again, the total output of the station for a given capacity often is considerably larger in the railway plant, with a better distribution of the demand throughout the different hours of the day. On the other hand, the development of apparatus in moderate-sized lighting plants has been somewhat more rapid of late years, with the general shift from high-frequency belted equipment to the more modern sixty-cycle, 2,300-volt, direct-connected apparatus.

Absence of a large motor load, also, has militated against the best economy of production, in many cases. Another point that has been helpful to railway plants in securing economy has been the more extended organization required for engineering work in such properties. Perhaps it is not overdrawing the facts to state that there is more opportunity on a system with a large number of employes to assign one or more men to the special economies of power production and distribution. Finally, one of the features of design which tends to raise the cost of generation in small central stations is the retention in service of belted units which ought to have been superseded

long ago, and with this often is found a poor arrangement of steam auxiliaries and piping.

It is certainly most important that in any business where the sale of a commodity is the fundamental feature, the cost of producing that commodity shall be cut to the lowest point consistent with reliable service. With the electric railway, the generation of power is an incident; with the central station it is the primary object of the property. Hence the central station can afford to study its generating costs with even greater thoroughness than the electric railway of the same plant capacity. Bearing in mind the influence of special conditions and unusual volumes of output, the central station will do well to pay more attention to the cost of production than it sometimes has; it will pay to spend money for active and skilled solicitation of new business for the sake of its influence on station efficiency as well as for its effect on the company earnings; and in conclusion, the station which fails to keep abreast of progress in power-plant design and allows old and inefficient equipment to remain in service when careful figuring proves the wisdom of a change, simply invites the perpetuation of high cost records on its log sheets.

HIGH-PRESSURE GAS IN BERLIN.

The city of Berlin, Germany, leads the world in the application of high-pressure gas, having some twenty-five miles of streets lighted with about 1,600 lamps on this system.

As an effort is being made in the United States to follow the lead of some European cities in street lighting with high-pressure gas, it may be profitable to consider just what has been done in Berlin, the city where this sort of street lighting has had the greatest success.

That the true bearing of the facts may be understood, it may be well to note the general situation at Berlin.

Electrical supply in Berlin is carried on by the Berlin Electricity Works, a private corporation, whose franchise expires in the year 1915, and it is expected that the plant and business will then be taken over by the city. Under these circumstances it is not to be expected that the city will care to build up the electric system with a large amount of street lighting.

The gas plant in Berlin is operated by the city, and this obviously furnishes another strong reason for the use of gas in street lighting.

In spite of these adverse conditions, electric lighting is found on some of the most important streets and squares in the city, notably in Brandenburger Square, said to be the best lighted of any in Europe.

Municipal ownership of the gas works at Berlin appears to have created or at least complied with a demand for a high degree of illumination in the city streets, and this has tended to put gas lighting in public places at its best. During the decade from 1898 to 1908, inclusive, the aggregate candlepower of all gas lamps on Berlin streets increased 158 per cent, while the area lighted increased only fourteen per cent, so that, in 1908, the candlepower per square yard was 0.336, in contrast with 0.146 candle per square yard illuminated in 1898.

Even in Berlin, the proportion of high-pressure burners to the total number lighted with gas is small, for in 1908, out of 32,342 gas burners in use on the streets, only about 2,563 were operated at high pressure. It should be noted that this comparison relates to the number of burners, as there are in many cases two or three burners to one gas lamp.

Of 1,612 high-pressure gas street lamps in Berlin, 661 are of the older upright type, and are rated at about 700 candlepower each. There are 700 inverted high-pressure gas lamps each having two mantles rated to consume 42.4 cubic feet of gas per hour. Besides the above, there are 251 three-mantle inverted lamps, some of which consume 84.75 cubic feet and others 65.33 cubic feet of gas per hour.

Christmas, 1907, marked the beginning of high-pressure gas street lighting in Berlin, and since that date several changes have been found necessary in the inverted lamps.

Both the two and the three-mantle inverted gas lamps are hung from iron standards at the curb line with the mantles 18.36 feet above the street, and 100 to 140 feet apart. In the Koniggratzerstrasse the three-mantle inverted lamps using 8475 cubic feet of gas per hour are suspended 138 feet apart, and as the width of this street is 93.5 feet, the consumption of gas per 100 square feet of road is 1.3 cubic feet per hour. The Potsdamerstrasse has inverted high-pressure lamps like those last named that are suspended 130 feet apart, and the width of this street is 120 feet, so that the gas consumption amounts to 1.076 cubic feet of gas per hour per 100 square feet.

According to tests reported by Professor Drehschmidt, the chemist of the Berlin municipal gas works, the mean lower hemispherical candlepower of each high-pressure inverted lamp burning 84.75 cubic feet of gas per hour is 3,365 candles, or 39.7 candlepower per cubic foot of gas per hour.

The two-mantle high-pressure lamp that burns 42.38 cubic feet of gas per hour gives about 1,470 candlepower, or 34.7 candles per cubic foot per hour, as a mean in the lower hemisphere.

As reported by the officers of the municipal gas plant, the above results in high-pressure street lighting at Berlin are attained at a rather large expense beyond the regular cost of gas. One man is required to keep each forty or fifty lamps in repair, and the pressure of the gas, about fifty-three inches of water, and the high temperature of the gas flame reduce the life of mantles to six or eight days.

Solely for the purpose of compressing the gas for the street lamps, three compressing stations are operated and two more of these stations are to be added at once. According to the gas officials, the cost of compressing the gas, renewals of the mantles, and of attendance on the inverted gas lamps is 13.5 cents per thousand feet of gas that these lamps consume.

All of the high-pressure lamps are lighted and extinguished by means of variations of pressure in the high-pressure

mains, and for this reason it is impracticable to supply private consumers from these mains. With twenty-five miles of seamless steel mains that vary from 1.6 to eight inches in diameter, and with the services to the lamps, it may be seen that there is a large investment in this item alone.

The regular rate for gas in Berlin is about eighty-four cents per thousand feet at the ordinary pressure, and the 13.5 cents given by the gas works as the cost of compressing brings the rate up to 97.5 cents per thousand for the high-pressure lamps. If it be assumed that 2.5 cents per thousand will cover the interest charges on the compressing plants and high-pressure mains, the price of gas for the street lighting may be taken at one dollar per thousand for the high-pressure lamps in Berlin.

As each of the three-mantle inverted lamps consumes 84.75 cubic feet of gas per hour, its consumption during 4,000 hours of annual lighting will be 339,000 cubic feet, and the cost of this gas at one dollar per thousand is $339 per lamp per year.

With the three-mantle lamps 130 feet apart along the Potsdamerstrasse, there are forty-one of these lamps per mile, and at the rate of $339 per lamp annually the cost of lighting this street is $13,899 per mile per year.

If cities are prepared to spend $13,899 per mile of streets annually for electric lighting they can turn night into day.

ELECTRICITY AND STAGE PICTURES.

Few persons outside the immediate field of theatrical productions realize the extent to which electricity has entered into play-making. It is doubtless the flexibility of electrical methods rather than their economy of energy which attracts the stage manager, although when one looks into the matter, there is no question that the labor-saving qualities of electrical applications are in the course of a season responsible for a real and important reduction in the wages which would otherwise have to be paid to auxiliary employes whose hands would be required simultaneously in many places.

To review the triumphs of electricity on the stage would require a volume's space, but in the latest individual applications one finds many suggestions of what has been done in the past and of what may be done in the future. Nowhere does the silent fireproof effectiveness of electric illumination show to better advantage than in the production of special lighting effects in connection with modern stage scenery. Thus, in the opera, "Madame Butterfly," in a scene reproducing Nagasaki Harbor, the approach of the evening was easily effected by dimming lamps, while at the same time the lights in distant homes and upon a pictured battleship at anchor in the roadstead came into play in the most natural manner. By delicate wiring methods the appearance of persons carrying lanterns about the ship was simulated, and the crowning success was produced by a regularly flashing lighthouse, seen at the harbor's edge, apparently many miles away.

The value of the low-voltage electric circuit in the production of lightning effects in such plays as "Faust" and "Rip Van Winkle" need not be elaborated here. The intense light emitted by short-circuiting terminals and drawing an arc behind the scenes enables the most picturesque effects to be secured. In a recent performance of "Hamlet" there is no question that the illusion of the "Ghost" was heightened by the use of special screened projection lighting along electrical lines. In all fancy dancing under different colored lights the electric projector offers a safe and reliable means of producing the requisite surroundings. In the new Boston Opera House, it is planned to enhance the brilliancy of dancing scenes by the use of a special glass floor, with arrangements of electric lamps beneath to meet all sorts of conditions. Perhaps the most recent example of electric illumination in theatrical work is afforded by the arrangements made for the production of "Joan of Arc" at the Harvard Stadium, Cambridge, Mass., by Miss Maude Adams, for the benefit of the Germanic Museum. The performance of this play out-of-doors at night required the use of arc lamps on the Stadium structure for guiding patrons to their seats, with electric lighting of entrances and exits. These lamps were cut off a few moments before the play began, and were replaced by two electric searchlights with thirty-inch projectors. Small colored incandescent lamps were also used here for calling players to the stage, instead of relying upon the usual call-boys. To obtain the effects of wind, rain, and thunder, a motor-driven forge blower has been used, connected with various sized whistles, and in combination with this a cylinder lined with corrugated iron and partially filled with shot is operated. Another motor-driven device is a 200-pound car, which is run back and forth upon planking to represent the rumbling of distant thunder, while a second device to convey the idea of the gathering fury of the storm is a horsehide drum six feet square, strung with balls of different size, the whole arrangement being revolved by a motor. There is no question that the use of small motors for work of this kind will be greatly extended in the future.

THE INSTITUTE CONVENTION.

The annual convention of the American Institute of Electrical Engineers will be held at Frontenac, N. Y., in the Thousand Islands, June 28 to July 1, where one of the famous summer resorts of the country should attract a large attendance, for the diversions, to give edge to the more serious business of the occasion, will be many. An excellent programme, published on another page, assures plenty of exercise for the mind and there will be a parallel session for those who desire to specialize, particularly in iron and steel rolling-mill work, which is attracting unusual attention nowadays.

THE INDEX FOR VOLUME LIV.

The Index for Vol. LIV of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN is distributed with each copy of this issue. Everyone is urged to preserve this copy, as the publishers cannot make an additional distribution.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

ANNUAL CONVENTION, FRONTENAC, N. Y., JUNE 28-JULY 1.

The annual convention of the American Institute of Electrical Engineers will be held at Frontenac, Thousand Islands, N. Y., June 28 to July 1. The natural attractions of this famous summer resort will undoubtedly attract a large attendance. An excellent programme has been arranged, and the entertainment features insure a pleasant period of recreation in addition to the technical session. The following programme has been announced:

Monday, June 28.

Morning Session—10 a. m.

President's Address, by Louis A. Ferguson.

"The Convection of Heat from Small Copper Wires," by A. E. Kennelly, C. A. Wright and J. S. Van Bylevelt.

"Alternator for 100,000 Cycles," by E. F. W. Alexanderson.

"Method of Testing Transformer Core Losses Giving Sine-Wave Results on Commercial Circuits," by L. W. Chubb.

"Testing of Transformer Steel," by M. G. Lloyd and J. V. S. Fisher.

Afternoon Session—2 p. m.

"A Sketch of the Theory of the Adjustable-Speed, Single-Phase, Shunt, Induction Motor," by F. Creedy.

"Repulsion Motor with Variable-Speed, Shunt Characteristics," by E. F. W. Alexanderson.

"The Heating of Induction Motors," by A. Miller Gray.

"Reduction in Capacity of Polyphase Motors Due to Unbalancing in Voltage," by S. B. Charters, Jr., and W. A. Hillebrand.

"The Current Locus of the Single-Phase Induction Motor," by A. S. Langsdorf.

"Multispeed Induction Motors," by H. G. Reist and H. Maxwell.

Tuesday, June 29.

Morning Session—10 a. m.

"Output and Regulation in Long-Distance Lines," by P. H. Thomas.

"Calculation of the High-Tension Line," by P. H. Thomas.

"Even Harmonics in Alternating-Current Circuits," by J. B. Taylor.

"The Resistance and Reactance of Armored Cables," by J. B. Whitehead.

"Losses, Induced Volts and Amperes in Armor and Lead Cover of Cables," by H. W. Fisher.

Tuesday evening at 6 p. m. there will be a dinner and discussion by the Sections Committee and Section Delegates.

Evening Session—8 p. m.

"Corona Phenomena in Air and Oil and Their Relation to Transformer Design," by W. S. Moody and G. Faccioli.

"Surges on Cable Systems with Aluminum Cell Protection," by E. E. F. Creighton and S. D. Sprong.

"Split-Pole Converters and Storage-Battery Regulation," by J. L. Woodbridge.

Wednesday, June 30.

Morning Session—10 a. m.

"Function of Fly-Wheels in Connection with Electrically Operated Rolling Mills," by H. C. Specht.

"Alternating-Current Motors versus Direct-Current Motors in Steel Mills," by K. A. Pauly.

"Rolling-Mill Motors," by E. W. Yearsley.

"Electric-Driven Rolling Mills," by E. Friedlander.

"Power Requirements for Rolling High-Carbon Steel of Small Section," by B. Wiley.

"Electrical Control for Rolling-Mill Motors," by C. T. Henderson.

"Automatic Motor Control," by H. E. White.

Parallel Session—Wednesday 10 a. m.

"Some Considerations in Designing Heavy-Capacity Fuses," by L. W. Downes.

"Comparative Costs of Twenty-five-Cycle and Sixty-Cycle Alternators," by C. J. Fechheimer.

"Calculation of Iron Losses in Dynamo-Electric Machinery," by I. E. Hanssen.

"Auxiliary Poles for Direct-Current Machines," by J. N. Dodd.

"Electric Measurements on Circuits Requiring Current and Potential Transformers," by L. T. Robinson.

"Electromotive-Force Wave-Shape in Alternators," by C. A. Adams.

Thursday, July 1.

Morning Session—10 a. m.

"The Modern Telephone Cable," by F. B. Jewett.

"Pole-Face Losses," by C. A. Adams, A. C. Lanier, C. C. Pope and C. O. Schooley.

"The Training of Non-Technical Men," by C. R. Dooley.

"The Value of the Classics in Engineering Education," by C. P. Steinmetz.

Entertainment.

The Convention Committee has made arrangements for the following events:

Monday evening, June 28, there will be a reception and dance at Hotel Frontenac.

Tuesday afternoon, June 29, there will be a qualifying round in a handicap golf tournament. The first eight will qualify for the semi-finals. There will also be a women's putting contest, accompanied by first, second and third prizes.

Tuesday evening, June 29, there will be a women's bridge tournament.

Wednesday morning, June 30, there will be a daylight excursion for women through the Thousand Islands on a large steamer.

Wednesday afternoon, June 30, the semi-finals of the golf match and a driving contest will be held.

Wednesday evening, June 30, there will be a searchlight trip of fifty miles among the islands on a large steamer for both men and women.

Thursday afternoon, July 1, the finals of the golf tournament will take place.

In addition to first, second, and third prizes in the women's putting contest, the following prizes will be given: First prize for men in golf tournament, also runner-up prize in men's golf tournament. There will be prizes for the best net score and the best gross score, as well as first and second prizes in the driving contests.

There will also be first, second, and booby prizes in the women's bridge whist tournament.

Prizes will also be given for the largest fish caught during the convention and also for the largest "catch."

It is proposed to have available a number of launches, which can take small parties around the islands, these parties to be made up by the individuals wishing to take the boat rides. Application may be made to any member of the Convention Committee. Golf will be available for men and women at any time, as the golf links are adjacent to the hotel and are readily accessible. There is a fine nine-hole course. Individuals can obtain guides and rowboats at a minimum charge for fishing at any time. The fishing is excellent.

Schedule of Events.

Frontenac, N. Y., Convention of A. I. E. E., June 28 to July 1, 1909.

Monday, June 28, 10 a. m., convention session; 2 p. m., convention session; 9 p. m., reception and dance, Hotel Frontenac.

Tuesday, June 29, 10 a. m., convention session; afternoon, golf tournament; 8 p. m., convention session; women's bridge tournament.

Wednesday, June 30, 10 a. m., convention session; 10 a. m., parallel session; steamboat excursion for women; afternoon, semi-finals in golf tournament; evening, searchlight excursion.

Thursday, July 1, 10 a. m., convention session; afternoon, finals, golf tournament.

A League of Electrical Interests at St. Louis.

On May 8 a dinner was held by a number of prominent men in St. Louis for the preliminary discussion of the formation of a league of electrical interests. A committee was appointed at this meeting to suggest a permanent form of organization. Another dinner was held on June 15, and the committee suggested that the organization shall be known as the "League of Electrical Interests." The representatives of the various electrical interests in St. Louis, recognizing the lack of co-operation either among themselves or with the public, aim to bring together in fraternal spirit and in co-operation all those interested in or identified with the electrical interests of the city of St. Louis.

The meeting was presided over by W. A. Layman, general manager of the Wagner Electric Manufacturing Company. An address was made by C. A. Houts, one of the leading attorneys of the city, in which the opportunities of such an organization to take a leading part in many phases of civic action was pointed out. The newspapers of the city were well represented, and gave the meeting considerable publicity. As a result of this, Mr. Robbins, the secretary of the organization, has already received communications from two bodies in the city of St. Louis, asking the co-operation of the new league.

An address was made by Frank N. Jewett, manager of sales of the Wagner Electric Manufacturing Company, in which a vigorous statement of the plans of the organization and the effectiveness which hearty co-operation would bring about were emphasized.

Capt. Robert McCulloch, vice-president of the United Railways Company of St. Louis, was elected president of the organization. Upon assuming the chair Captain McCulloch delivered a vigorous speech indicating his active interest in

the organization and the possibilities for effective work in the future.

The committee of organization, which has under way the completing of plans already outlined, is as follows: Captain R. McCulloch, chairman ex-officio; S. A. Hobson, H. H. Humphrey, F. E. Newbery, W. Robbins, secretary, ex-officio.

Canadian Electrical Association.

The nineteenth annual convention of the Canadian Electrical Association was held at the Chateau Frontenac, Quebec, Canada, on June 16, 17, and 18. It was seven years since the association had held a convention in Quebec, and the recollection of its charms and historic places therefore brought out an exceptionally good attendance. The convention meetings showed a decided increased interest in matters relating to electrical men, and the discussions of the papers presented, while not very extended, brought out the most pertinent aspects of the questions of the day.

The first session of the convention, that on Wednesday morning, was devoted principally to routine business matters. Following the address of President W. N. Ryerson, there were presented the reports of Secretary-Treasurer T. S. Young, and of various committees. B. T. McCormick, of Allis-Chalmers-Bullock, Limited, Montreal, read an interesting paper on "Synchronous Motors for Correction of Power-Factor."

At the afternoon session papers were presented by L. W. Pratt, of the Hamilton Electric Light and Power Company, on "Power Rates for Central Stations;" S. E. Doane, of the National Electric Lamp Association, Cleveland, Ohio, on "The Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps;" R. J. Smith, of the Canadian Electric and Water Power Company, Perth, Ont., on "The Small Central Station and Its Practical Management;" and by R. F. Pack, of the Toronto Electric Light Company, on "Accounting for Electrical Companies."

At the session held Thursday papers were submitted by G. P. Cole, of Allis-Chalmers-Bullock, Montreal, on "Considerations Affecting the Choice of Type in Transformers;" Professors L. A. Herdt and J. Dalemont, of McGill University, Montreal, on "Electrolytic Lightning Arresters;" and by W. A. Bucke, on "Power-Plant Statistics." Following this there was a topical discussion on business-getting methods, that was led by E. J. Phillip, of Berlin, Ont., H. O. Fisk, of Peterboro, Ont., and E. A. Evans, of Quebec.

The Friday session began with a topical discussion on the use of transformers for general distribution that was opened by J. W. Purcell, of Walkerville, Ont., P. S. Coate, of Chatham, Ont., and I. H. Wright, of North Bay, Ont. This was followed by a paper on "Gas Engines and Plants," by Wm. F. Flint, of the Westinghouse Machine Company, Pittsburg, Pa., and a paper on "Insurers and Insured; Illusions and Delusions," by E. P. Heaton, of the Canadian Manufacturers' Association, Toronto, Ont. After a general discussion of the rules of the Railway Commission of Canada governing the crossing of railways by electric wires and the transaction of other business matters, the convention finally adjourned.

One of the matters disposed of was the annual election of officers, as the result of which there were chosen for the year 1909-10 the following: President, W. N. Ryerson, general manager of the Great Northern Power Company, Duluth, Minn. (re-elected); first vice-president, P. S. Coate, Chatham, Ont.; second vice-president, E. A. Evans, Quebec; secretary-treasurer, T. S. Young, Toronto (re-elected). As members of the managing committee there were chosen the following, the first four named being re-elected: R. S. Kelch, Montreal; R. G. Black, Toronto; A. A. Dion, Ottawa; H. O. Fisk, Peterboro, Ont.; A. L. Mudge, Toronto; R. J. Smith, Perth, Ont.; W. L. Adams, Niagara Falls; W. M. McFarlane, Cornwall, Ont.; and F. A. Chisholm, St. Johns, Quebec.

Among the entertainment features that were enjoyed by the members and guests were trolley rides about Quebec on Wednesday evening, visits to Laval University and to Chaudiere Falls on Thursday afternoon; dinner at the famous Kent House, Montmorency Falls, and performance at the rustic theatre on Thursday evening; steamer rides around Quebec harbor and to the site of the collapsed bridge on Friday afternoon, and a band concert on Dufferin Terrace that evening. Informal inspections were also made to the various power houses and substations in and near Quebec. Special arrangements were made for the entertainment of the ladies. General satisfaction was expressed with the arrangement of the programme, in which both business and pleasure were mingled in a proper balance for the benefit of all who attended the convention. A more detailed report of the technical proceedings will be given in the next issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

The Chicago Electric Club.

At the noonday meeting of the Chicago Electric Club, held in the grill room of the Chicago Automobile Club on Wednesday, June 16, owing to the absence of the speaker for the day, an informal discussion of the early days of electrical development was indulged in. The first speaker was W. D. Ray, of the Chicago Sanitary District, who took his listeners back twenty-odd years with a number of interesting reminiscences. Mr. Ray was followed by Donald M. Carter, who told of some of his early struggles with the old Sperry regulator and the first plant which was installed for the Union Railway in Chicago.

J. B. Mabbs, chief engineer of the Chicago Board of Trade, followed with his reminiscences. Mr. Mabb started with the old M. C. Bullock Company in 1880, at whose plant an installation of six Brush arc lamps was installed in 1881, the bare copper wire being fastened to the wooden beams with staples and running from eight to ten inches apart. He also described the lighting of the old Exposition Building and called attention to the old incandescent lighting switchboard, which, it will be remembered, was built of maplewood flooring.

The discussion was also participated in by Messrs. Millard, Pomeroy, Scheible and Keily.

Upon a motion of the entertainment committee it was decided to hold a picnic on Saturday, July 17, the place to be decided later.

Whitney Power Project.

The rapid completion of the Whitney waterpower development at Salisbury, N. C., said to be the second largest in the United States, and on which several million dollars have been expended, is said to be assured by the report filed by Special Master Price in the case of the T. A. Gillespie Company, of Pittsburg and New York, against the Whitney Company.

George I. Whitney, of Pittsburg, was president of the Whitney Company. The report allows the claim of T. A. Gillespie, for the T. A. Gillespie Company, in full, thereby establishing the priority of his lien for $300,000 over a mortgage which is held by the Bankers' Trust Company, of New York.

Chicago Section, Illuminating Engineering Society.

The concluding meeting for this season of the Chicago Section of the Illuminating Engineering Society was held at noon, June 17, in the Chicago room of the Great Northern Hotel. The meeting was exceptionally well attended, as the annual election of officers for the ensuing year was scheduled to take place. This matter was brought to the attention of the society through the report of the nominating committee, which was unanimously adopted, and the following declared elected as the officers for the coming year: Albert Scheible, chairman; T. R. Beebe, secretary; J. R. Cravath and E. W. Lloyd, managers. Following this election short addresses were made by the incoming chairman and secretary.

An illustrated lecture on "Decorative Lighting" was delivered by Albert Frank Horton, of the "Electric Shop" of the Commonwealth Edison Company. The speaker declared that lighting to be effective must be in good taste as well as efficient. The architect is the storm center between the decorative and constructive industries. The design of fixtures is of prime importance, because on the efficacy of the lighting from them depends the resulting display of the objects illuminated. The fixtures must be in architectural harmony with the general design and purpose of the room. The fixture designer must be in sympathy with the architect and the illuminating engineer. The contract for the fixtures should receive early attention, in order to have the proper amount set aside for their cost. Very commonly the fixtures are left almost to the last, when the owner has almost exhausted the funds he proposes to put into the building. The speaker considered that five per cent of the cost of the building was necessary for appropriate fixtures.

Mr. Horton does not believe that much light should be cast on the floor, and more light than usual should be dispersed to the walls and ceiling. If the walls, ceiling and furniture of the room are of a light color, a low degree of illumination is needed, but if dark, much lighting is required. The proportions of the room can be distorted by the placing and the character of the lighting. Local and general illuminating must be treated separately. For local lighting a too concentrated illumination is now very common and for general lighting uneven distribution is prevalent. The speaker advocated the use of side lights as well as ceiling lights for illuminating the space between the wainscoting and frieze on the walls. In high rooms only should very bright sources be used, and then they should be placed near the ceiling.

Following Mr. Horton's general remarks, a large number of views were thrown on the screen that illustrated various interiors properly and in many cases improperly illuminated. The speaker criticized these from both the artistic and illuminating standpoints. Quite a number of fixture designs were also shown that were declared to be particularly appropriate for those interiors that had been shown to be improperly treated. In some cases an elaborately furnished room was shown with fixtures that were too plain or not of the same style of architecture. In others the fixtures were too elaborate or of too many varieties. A number of very beautiful rooms were shown in which the fixtures harmonized excellently with the general decorative scheme.

New York Section, Illuminating Engineering Society.

The last meeting of the present season was held by the New York Section of the Illuminating Engineering Society on the evening of June 10 at the United Engineering Societies Building. When Chairman E. L. Elliott called the meeting to order the room was completely filled and after a short business meeting Louis J. Auerbacher was introduced. His paper was on the "Evolution and Development of the Flaming-Arc Lamp."

He called attention to the fact that the cored carbon dates back as far as commercial arc lighting in this country. In 1899 the Weston Machine Company manufactured 150 flaming-arc lamps, which were not successful, principally owing to their yellow light.

In 1900 Bremer obtained his first American patent, and in the same year exhibited a lamp at the Paris Exposition. The carbons had a life of only five to six hours and the lamp did not become a commercial success until the carbon manufacturers took hold of them, so that now carbons are made which will burn for twenty hours.

About the same time that Bremer was working with his inclined-carbon arc Blondel took up the development of a lamp using vertical carbons, and in the last year the Siemens-Halske Company has brought out a similar lamp. In 1905 Heinrich Beck brought out his supported-carbon or so-called gravity-feed lamp.

The comparatively short run of the flaming arc, viz., about twenty hours, has worked much to prevent its general introduction, especially in the United States, where the costs of carbon and labor are high.

In 1903 the Westinghouse-Bremer lamp, having five sets of carbons with a life of forty hours, was introduced in England. Early this year an Excello lamp having two sets of carbons and a life of thirty hours, was brought out. In 1908 another type of flaming arc was brought out by Jandus, called the "Regenerative."

The discussion was opened by Mr. Martin, who inquired as to the use of large versus small units in commercial lighting. In reply Mr. Auerbacher stated that the standard so-called 3,000-candlepower and 2,200-candlepower lamps would be as large as would seem necessary, and that, as far as small units were concerned, the ten-ampere arc is about as low in current as can be successfully operated.

Mr. Gardner asked if the tendency, as regards color, was toward the white light. Mr. Auerbacher said that although the customers usually ask for the carbons which give a white light, it was found that after they became accustomed to the yellow light they were generally more satisfied, especially as the efficiency of the yellow carbon is forty per cent higher than that of the white carbon.

Mr. Millar called attention to the fact that 6.6-ampere lamps had been used successfully on series circuits in Boston and that a three-ampere arc was exhibited at the recent Atlantic City convention.

Mr. Wohlauer referred to the fact that the magnetite and titanium lamps were not included in the paper, and in reply the author stated that he had left them out on purpose, as they do not belong to the flaming type and are in a separate class entirely.

Professor Ganz called attention to several features of the Jandus arc which would seem to make it most satisfactory for indoor use. He also inquired as to the meaning of 3,000 candlepower. In reply, Mr. Auerbacher stated that the Jandus lamp had not been perfected and further that the fumes from the present flaming-arc lamps were considerably less than had been formerly the case. Regarding candlepower, the Bureau of

Standards was now working upon this question, but at present the manufacturers' ratings were used.

The discussion was closed by E. L. Elliott in a most interesting manner, as he took up many of the points raised during the discussion and reviewed them with many telling comments.

The second paper of the evening was not printed in advance and it consisted mainly of a topical discussion by the authors, E. B. Rowe and A. A. Wohlauer, on "The Illumination Efficiencies of Various Types of Lighting Installations."

Reconstruction of Street-Car Tracks in Chicago.

At the meeting of the Western Society of Engineers, held on the evening of June 16, George Weston, representative of the City of Chicago on the Board of Supervising Engineers, Chicago Traction, presented a paper on the "Reconstruction of Street-Car Tracks in Chicago." As a whole, the paper was devoted to the design and construction of the actual trackwork now being carried out.

Three types of construction had been decided on. In the first a concrete foundation was used, with steel ties placed four feet apart and entirely embedded in concrete. The second type is similar to the first, except that treated wood ties are used in connection with tie plates and screw spikes for fastening the rail to the tie. A modified form of the second type, known as No. 2A, provides for the tie spacing of three feet, center to center. Type No. 3 consists of a rolled broken-stone foundation with wood ties at three-foot centers and tie plates and screw spikes, as in type No. 2. Type No. 2A has been used mostly. The third type is being used for emergency and special work and in unimproved streets.

The wood ties used receive a preservative treatment with the chloride-of-zinc process. This, it was believed, would be amply sufficient, inasmuch as the ties are embedded in concrete, so that there is little opportunity for the preserving salt to wash out. The general design of the trackwork was to make the substructure, consisting of the foundation and ties, substantially permanent, and to enable the superstructure, consisting of the rails, tie rods and paving, to be renewed when worn out without disturbing the substructure.

A careful study of the subject of bonding led to the adoption of electric welding for this purpose on all straight work. The rails used are of fifty-six and fifty-eight-foot lengths, and the joints are of equal or better conductivity than the rail itself. Special work has been joined by means of bolted joints, and at these copper bonds are used in conjunction with auxiliary copper cables, embedded between the tracks. In laying out the special work great care was taken to arrange curves so that with the long cars in use ample clearance is provided for cars operating in opposite directions without interference or delay. The special work is built up in many cases of solid manganese steel and in other cases hardened-center construction, applying the same material, has been used. Practically all of the concrete work done has been by the aid of concrete-mixing machines, of which each of the companies made use of a special type.

After the first few months of construction work, a study was made of the rigidity and action of the different types of track construction under traffic conditions. An instrument called a deflectometer was made use of. It was found that the maximum vertical deflection was only five-sixty-fourths inch and that the average seemed to be one-thirty-second inch. No deflection whatever was observed in the concrete, and in only very few cases was any deflection of the ties recorded. It was noticed that in almost every test horizontal movement of the rail was recorded; the average movement was about one-sixty-fourth inch.

In opening the discussion, H. B. Fleming, chief engineer of the Chicago City Railway Company and its representative on the Board, described briefly the three ways made use of to handle the traffic during the reconstruction. The first method was single-track operation with turnout switches on lines where the traffic was comparatively light. The second by diversion to nearby parallel lines. The third by laying a temporary third track near the curb line. This last method has been used mostly, and has given very good results. By means of it on the most important lines the densest traffic, having a headway of only twenty seconds between cars, was maintained better than in normal operation where the street traffic offers impediments.

P. E. Green, engineer of the Board of Local Improvements, City of Chicago, submitted a written discussion, in which he criticized many of the methods and plans that have been used in the reconstruction work. He found fault particularly with the beveled edge of the rail section, which he claims resulted in poor paving adjacent the rails.

R. F. Kelker, Jr., division engineer in charge of track work, spoke at length upon the electric welding process made use of. The direct trolley current is converted into alternating current of about 300 volts and then transformed to about five volts and 30,000 amperes for the welding circuit. Three welds are made at each joint. When the temperature is correct, according to the judgment of the foreman in charge, great pressure is applied by hydraulic means. The speaker contrasted the method used with that employing cast welds, and stated that electric welding was doubtless best for the particular section of rail adopted. No provision whatever is made for temperature expansion, nor in accordance with the season when the welding is done. Only a very small percentage of failures have resulted. It has been noticed that over ninety per cent of the few breaks that do occur are outside of the welding bar, that is, in the rail proper, sometimes even in the middle of the rail.

In reply to questions by C. R. Dart, in regard to the experience with manganese steel casting for special work, Mr. Weston stated that much difficulty has been met with by the manufacturers, and only a small part of the pieces cast were ever submitted to the Board's inspectors at the foundry on account of the large number of defective castings. Answering the objections of Mr. Green, Mr. Weston explained why the bevel was adopted on the rail section, and he showed that the manner in which the paving had been planned was not that in which the city had directed it to be carried out. He also stated that the delays that have occurred were largely due to the Board of Local Improvements; notwithstanding this, however, remarkable progress has been made, and by far the greater part of the reconstruction work is now completed.

Others that joined in the discussion were E. N. Layfield, W. F. Graves, Mr. Goodenough and President Allen.

The cost of the central-station plants existing in 1907 in the United States was just $1,000,000,000; the capitalization of telephone systems was $1,100,000,000, and the capitalization of street railroads was about $4,000,000,000, making a grand aggregate of $6,100,000,000, and for 1908 about $7,000,000,000.

THE CONTROL SWITCHBOARDS FOR THE POWER HOUSE EQUIPMENT AT THE INDIANA STEEL COMPANY'S NEW GARY WORKS

BY E. A. LOF.

The generating equipment of the present power house for the Indiana Steel Company's new Gary works consists of nineteen 2,000-kilowatt generators. Seventeen of these are direct-connected to horizontal, twin-tandem, double-acting gas engines, while two of the units are Curtis steam turbo-generators. Seventeen of the generators are of the alternating-current type, wound for three-phase, twenty-five cycles, 6,600 volts, and two are of the direct-current type, wound for 250 volts. Gas for the engines is obtained from the eight blast furnaces now installed at the works.

On account of this large capacity, the power house is divided into two stations, power stations Nos. 2 and 3, respectively. Station No. 2 consists of eight gas-engine-driven alternating-current generators and two alternating-current turbo-generators, while station No. 3 consists of seven gas-engine-driven alternating-current generators and two gas-engine-driven direct-current generators. Both these stations have entirely separate switchboard equipments, but provision is made in the same sc that the two stations can be tied together and operated in parallel. Fig. 1 shows a general plan view of the power house, units 1 to 9 belonging to station No. 3, and units 10 to 19 to station No. 2.

For the excitation of the generator fields there are provided three 500-kilowatt, 250-volt exciters, direct-driven by three-phase, twenty-five-cycle, 6,600-volt synchronous motors. One of these exciters is for station No. 2, the other for station No. 3, and the third for spare purposes. Provision is made, however, so that all the exciters can be tied together and run in multiple, and also so that they can be connected in parallel with the two direct-current generators in station No. 3.

For the regulation of the fluctuations in the alternating-current load, there is provided one 8,000-ampere-hour storage battery, located in a separate building north of the power house. The alternating-current regulation is done by means of a 2,000-kilowatt, split-pole rotary converter, with the necessary auxiliary machinery, such as synchronous motors, converters, etc. A spare rotary converter is also provided. For the direct-current regulation, two 2,000-ampere, sixty-volt booster sets are installed, with the necessary exciter and regulator.

The connections for the alternating-current generators are shown in Fig. 2, from which will be seen that there are two separate sets of three-phase alternating-current busbars and that the generator leads are branched out in two circuits, each feeding through an oil switch into one set of the busbars. The leads which connect the alternating-current generators with the busbars consist of paper-insulated, three-conductor, lead-covered cable, running in the basement in a cable table and up to the generator oil switches, which are located on the main floor, as shown in Fig. 3. The oil switches are of the oil-insulated cell type, electrically operated and non-automatic, that is, not provided with overload feature. Instead of this, there is provided for each set of generator switches a reverse-current relay, which will automatically open the generator switch upon a reversal of current through the generator leads. These reverse-current relays are mounted on a separate panel, which is located at the end of the busbar structure. This panel is shown in Fig. 4. On each side of the generator oil switch, there are three disconnecting switches, so that the oil switch can be entirely disconnected from the generator side as well as from the busbar side.

As stated before, there are two sets of three-phase busbars. These busbars consist of laminated copper bars one-fourth by three inches, supported on high-tension insulators, and located in brick compartments right above the generator oil switches, as shown in Fig. 3.

The alternating-current feeder circuits are fed from the busbars through two oil switches for each feeder, one switch for each set of the busbars. The wiring diagram for the connection is shown in Fig. 6, and the arrangement of the structure in Fig. 3. The oil switches are of the same type as for the generators, but have automatic overload instead of reverse-current protection. The relays are of the inverse-time-limit type and are mounted on a switchboard panel, as shown in Fig. 5.

Each feeder circuit is equipped with disconnecting switches on each side of the oil switch, and for each circuit there is provided a multi-gap lightning arrester located on the inside wall, where the feeders leave the building. Each arrester has three disconnecting switches so that the arrester can be disconnected from the circuit for repair and inspection. To each set of the busbars is connected one set of three-phase electrolytic lightning arresters. Fig. 7 shows the substantial construction of one of the 1,200-ampere, 6,600-volt disconnecting switches.

The busbar and oil-switch structure is built of brick with concrete barriers and all the outside surfaces are lined with white enameled brick. To give the structure a very substantial construction to withstand the vibration from the generating equipments, an iron skeleton framework was built for reinforcing the brickwork, and this has proved very satisfactory.

The doors for the oil switches are of a very light but substantial construction, being made of asbestos wood and pro-

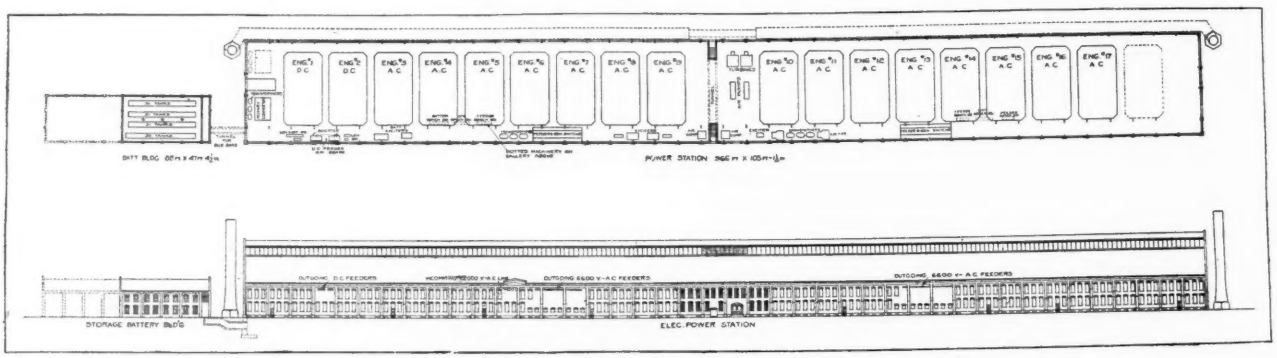


FIG. 1.—PLAN AND ELEVATION OF POWER STATIONS NOS. 2 AND 3 AT THE GARY STEEL WORKS.

vided with a transparent wire-glass so that the interior of the switch can be seen without removing the doors.

In station No. 2 there are installed ten 10,000-kilowatt feeder circuits, and in station No. 3 nine circuits of the following capacities: Two of 10,000 kilowatts, two of 3,000 kilowatts, two of 2,500 kilowatts, and three of 1,000 kilowatts. Besides these there is one 9,000-kilowatt circuit which is stepped up to 22,000 volts and connects through a transmission line with the works of the Illinois Steel Company at South Chicago.

For tying the two stations together a tie line runs outside of the power house and connections from the same are made to the busbars in each station through two 10,000-kilowatt automatic oil switches in the same manner as the feeder circuits are connected, with the exception, of course, that the necessary synchronizing apparatus is included. Both the 22,000-volt circuit and the tie circuits are provided with multi-gap lightning arresters.

Fig. 8 shows the wiring diagram for the direct-current generators. From this will be seen that these generators are protected with three-pole, carbon-break circuit-breakers. The positive and equalizer circuit-breakers are non-automatic and rigidly connected and operated by one motor, while the negative circuit-breaker is provided with overload and reverse-current coils and operated by a separate motor. The positive circuit-breaker has a capacity of 10,000 amperes and that in the equalizer 2,000 amperes. These two circuit-breakers are located on one panel, whereas the negative breaker, which also has a capacity of 10,000 amperes, is located on another panel. The panels are erected separately so as to have the opposite polarities on separate switchboards and thus minimize the danger of short-circuits. This construction is shown in Fig. 9. The opening of the breakers completely disconnects the generator from the busbars. Should, for any reason, a reversal of the current in the generator leads take place the reverse-current feature will at once open the circuit-breaker, and the same cannot be closed until the voltage of the machine is the same as that of the busbars, so that no reversal of current is possible. The circuit-breaker panels, which are located on the main power-house floor in front of the respective generators which they control, are also equipped with recording wattmeters. The generator leads consist of bare copper bars separated from each other by means of copper spacers. The leads are supported on hangers and brackets and insulated by slate as shown in Fig. 9. This shows also the main generator busbars, which are suspended on hangers underneath the gallery floor.

Four 500-kilowatt, one 1,000-kilowatt, three 1,500-kilowatt and one 2,000-kilowatt direct-current feeder circuits are provided and the feeder switchboard is located on the gallery right above the generator switchboards. Like these, it is divided into two separate boards, one for

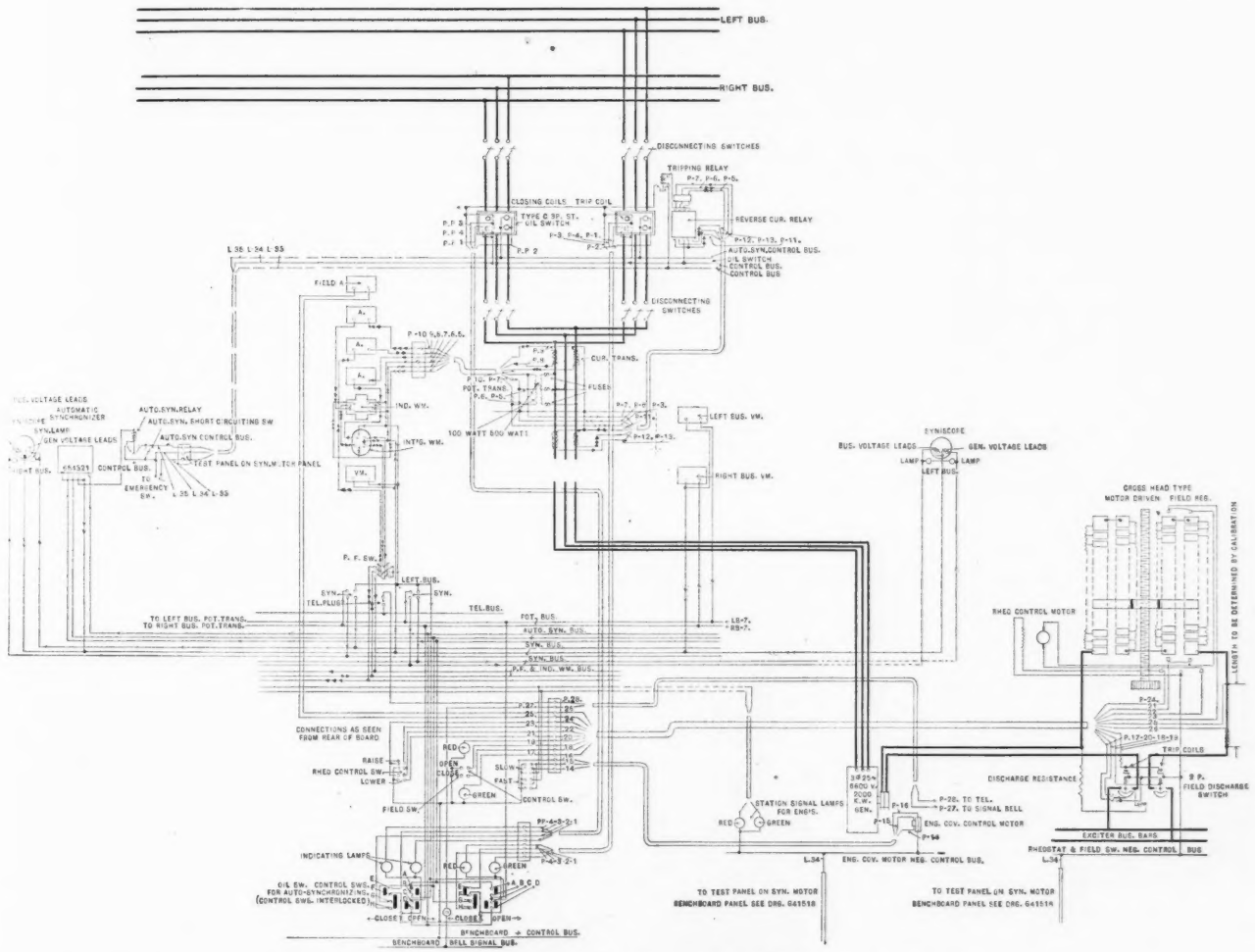


FIG. 2.—WIRING DIAGRAM FOR ALTERNATING-CURRENT GENERATORS.

the positive leads, which are protected by carbon-break circuit-breakers, and one for the negative leads, which are equipped with knife switches. Fig. 10 shows this

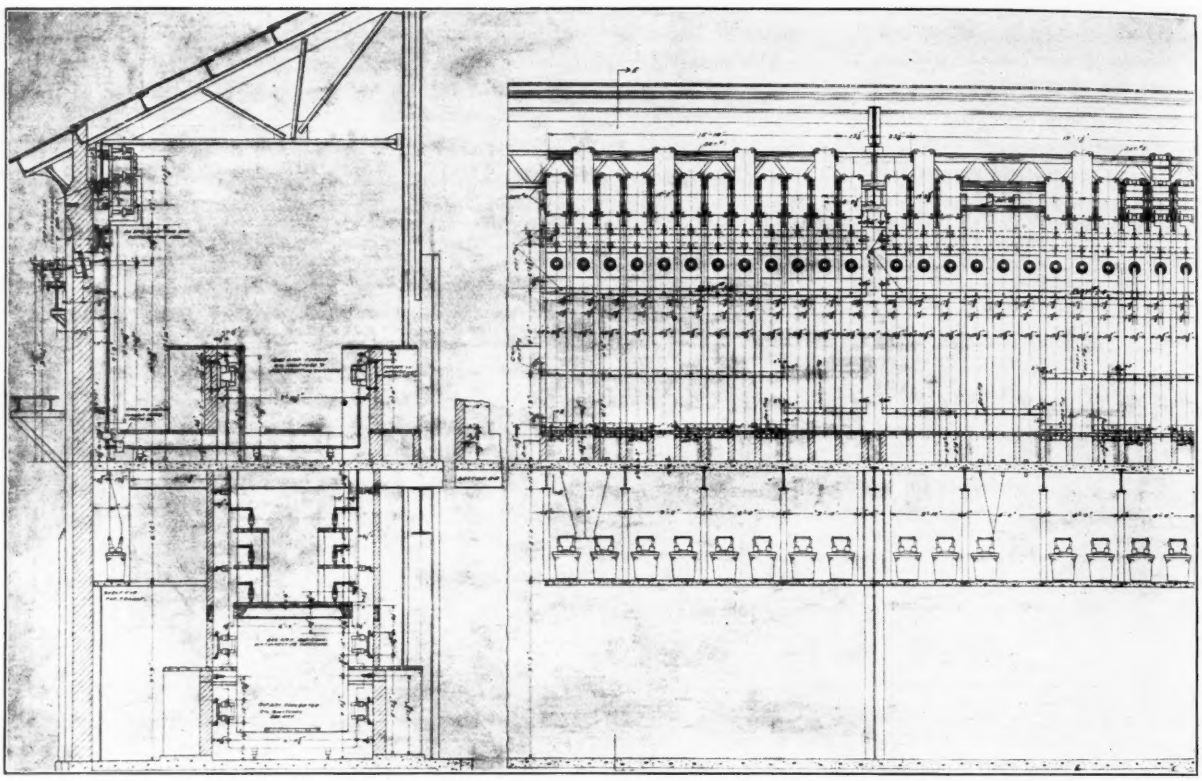


FIG. 3.—ALTERNATING-CURRENT BUSBAR AND OIL-SWITCH STRUCTURE.

board. The circuit-breakers are provided with overload and inverse-time-limit attachments which will allow the circuit-breakers to stay closed when the load is at or less than the adjustment of the breaker; but should the current rise above the ampere value of the adjustment, then the time required for the breaker to open is decreased in inverse proportion to the square of the current. A recording wattmeter is mounted on each of the negative panels besides the knife switch. The diagram shown in Fig. 11 gives an idea of how the feeder connections are made.

All the carbon-break direct-current circuit-breakers are of the laminated brush type, motor-operated and controlled from the benchboard. When the control switch is thrown to the closing position the motor is put in circuit and a magnet is energized. This magnet forces a worm on the end of the motor shaft into mesh with a worm gear, which is connected by means of a rod to the closing arm of the circuit-breaker, at the same time cutting out the control switch at the benchboard and thereby connecting the motor directly on the control bus. The circuit-breaker is fully closed in about three-fifths of a second, at which time the position of the laminated contact operates another switch which opens the motor magnet and circuits, thus throwing the worms out of mesh and at the same time putting the control switch into circuit ready to open the circuit-breaker, which action again throws the motor switch into the closing position. The circuit-breakers cannot be closed if an overload exists in the circuit, nor is there any control from the time the motor is started until the breaker is fully closed.

FIG. 4.—REVERSE-CURRENT RELAY PANEL.

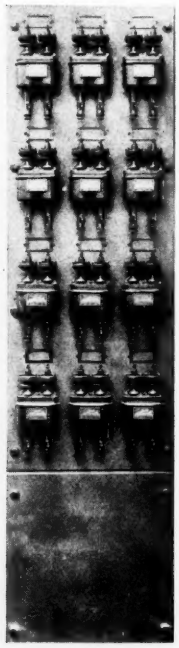


FIG. 5.—OVERLOAD INVERSE-TIME-LIMIT RELAY PANEL.

As before stated, there are provided three 500-kilowatt, 250-volt exciters direct driven by 6,600-volt, three-phase synchronous motors. One of these exciters is for the field excitation of the gas-engine-driven generators in power station No. 3, one for the excitation of the gas-engine-driven generators in station No. 2, and one for spare. Besides these there is for the excitation of the two turbo-generators one seventy-kilowatt, 125-volt induction-motor-driven exciter. The 500-kilowatt exciters are arranged so that they can be run either single or in multiple and also in parallel with the two 2,000-kilowatt, direct-current generators. For each synchronous motor there are provided two non-automatic, three-pole, single-throw oil switches with one double-pole, reverse-current relay, the connections being approximately the same as for the generators.

The exciter sets are started from the direct-current side from a separate starting bus. The starting is accomplished by closing a double-pole, non-automatic circuit-breaker, which connects in the posi-

tive and equalizer leads, and the closing of this circuit-breaker energizes the automatic starter. When the last contactor of the starter is closed, which is indicated by a signal on the benchboard, and the motor is up to speed, the synchronous motor is synchronized with the main alternating-current busbars, after which the starting-breaker is tripped, which in turn disconnects the automatic starter. The exciter is then paralleled with the other exciters or the direct-current generators, as the case may be, by closing the single-pole negative circuit-breaker first and then the positive breaker.

The exciter switchboards are located in front of the respective exciter sets and are of the same construction as the direct-current generator switchboards. The copper connections are run to the basement and carried underneath the generator cable table past all the generators to the fields of which taps are made through double-pole, solenoid-operated, field-discharge switches and crosshead-type, motor-operated rheostats. These field switches and rheostats are also located in the basement close to the cable structure and in front of their respective generators.

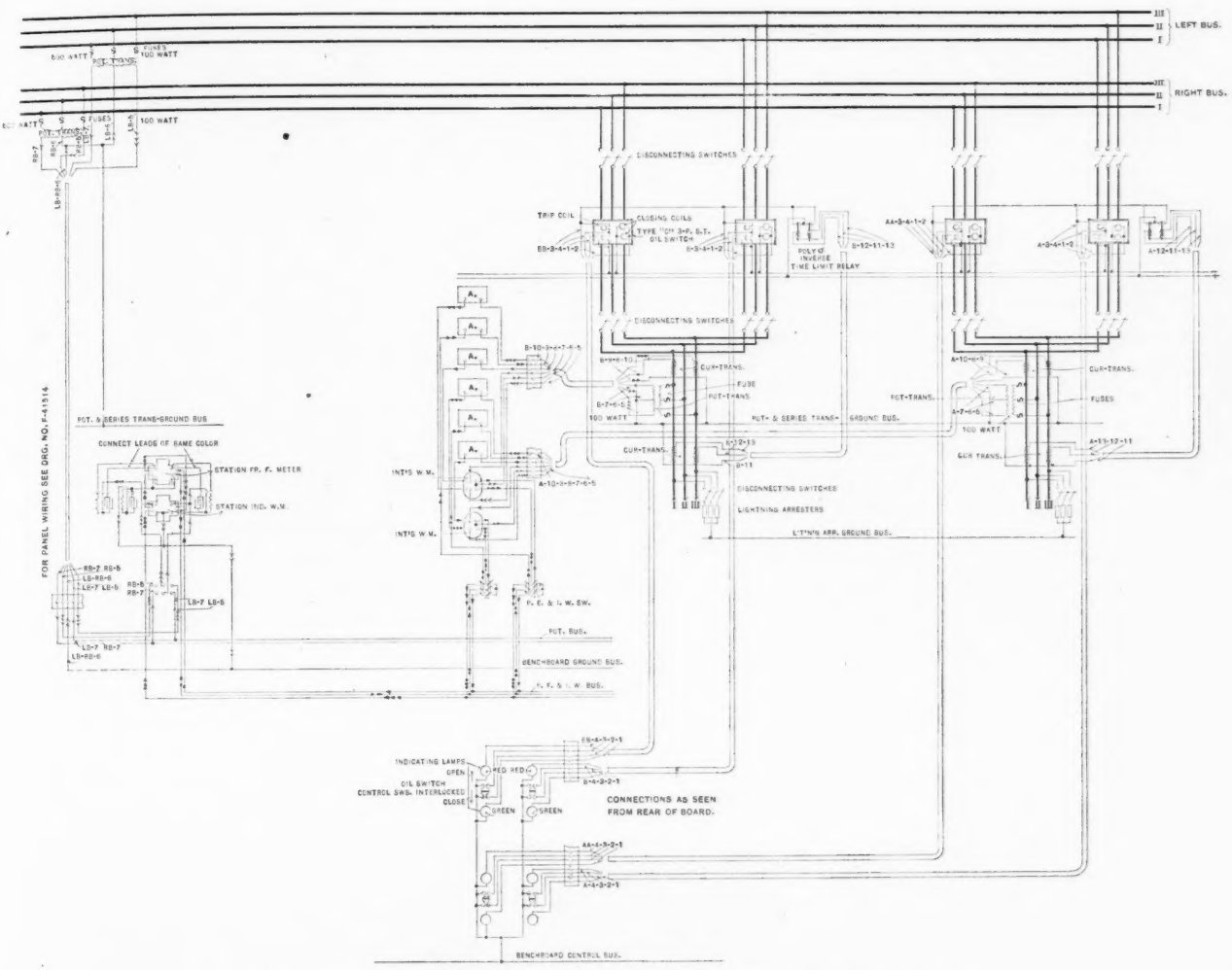


FIG. 6.—WIRING DIAGRAM FOR ALTERNATING-CURRENT FEEDER CIRCUITS.

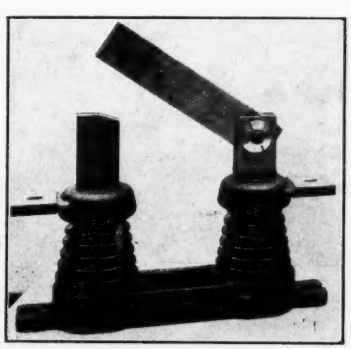


FIG. 7.—12,000-AMPERE, 6,600-VOLT DISCONNECTING SWITCH.

The large storage battery which is installed in the battery house north of the power house is intended for regulating and minimizing the fluctuation of the load on the generating station. The battery is divided into two parts connected in parallel, each section consisting of 125 cells with seventy-four plates per cell. Each part is rated at 4,300 amperes with a momentary overload rating of two to three times this amount.

For the direct-current regulation of this battery two 2,000-ampere, sixty-volt boosters are provided. These are of the interpole type, excited from a separate motor-driven exciter whose field excitation is regulated by means of a carbon regulator inserted in the positive feeder busbars. A single-pole, automatic, 2,000-ampere overload circuit-breaker is installed in the positive generator leads and a single-pole, automatic, 500-ampere overload circuit-breaker in the positive motor leads. Both these circuit-breakers are, besides the overload attachment, provided with low-voltage coils connected to the speed-limiting device on the booster set.

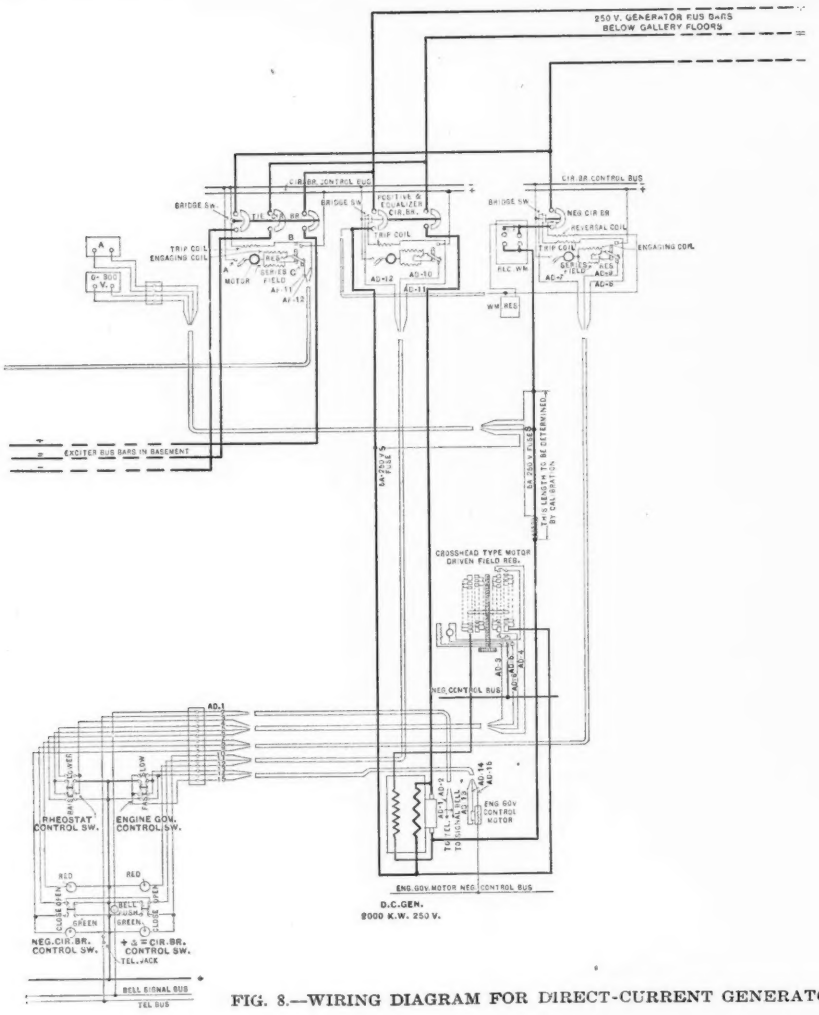


FIG. 8.—WIRING DIAGRAM FOR DIRECT-CURRENT GENERATORS.

volt alternating-current main busbars through step-down transformers and the alternating-current side of the rotary is protected with electrically-operated oil switches provided with overload and inverse-time-limit relays.

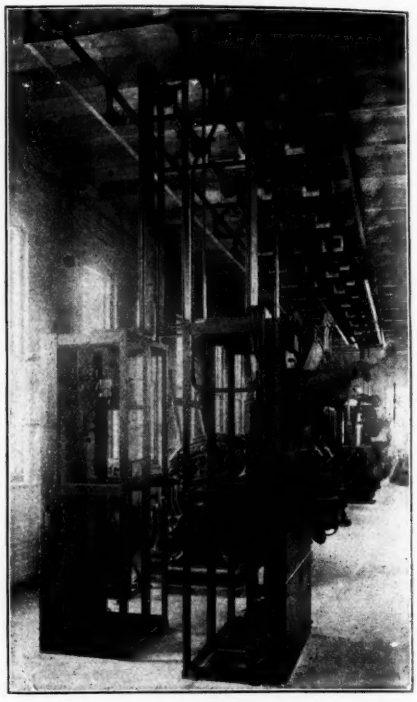


FIG. 9.—DIRECT-CURRENT GENERATOR SWITCHBOARDS.

The rotary converter is started from the direct-current side, the positive lead

The generator and motor circuit-breakers are also mechanically interlocked, but can be closed independently and are so wired up that whether closed from the bench-board or by hand at the circuit-breaker switchboard, the generator circuit-breaker cannot be closed before the motor circuit-breaker, nor can it be kept closed with the motor circuit-breaker open. In the negative leads are installed knife switches and the automatic contactor starters are connected so that the generator circuit-breaker cannot be closed with the motor circuit-breaker closed and the starter open, thus preventing the booster generator from taking current from the busbars and running as a motor. Besides being excited from a separate exciter, the booster is provided with a double-throw field switch which makes it possible to excite the booster field from the main exciter busbars.

Of the two 2,000-kilowatt rotary converters which are for the alternating-current regulation, one is a spare unit, but can also be used for regulating the power factor. Current is fed from the 6,600-

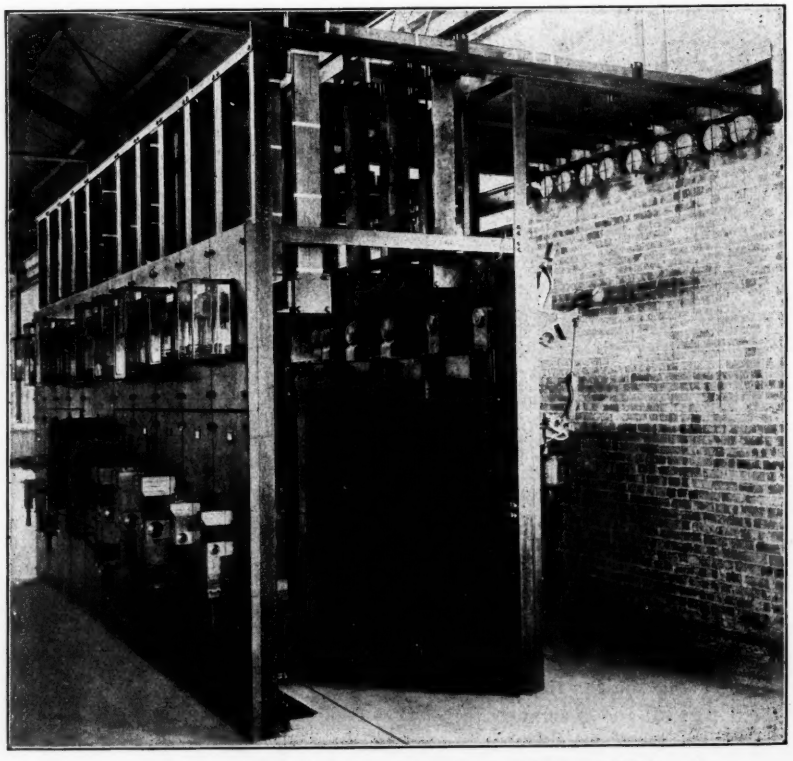


FIG. 10.—DIRECT-CURRENT FEEDER SWITCHBOARDS.

being provided with two single-pole motor-operated circuit-breakers, one for starting and the other for running. The starting breaker has a capacity of 1,500 amperes and the running breaker 10,000 amperes. By means of knife switches the positive side of the rotary can be connected to either the storage battery or to the direct-current positive bus.

The automatic starter, consisting of six 1,500-ampere magnetic contactors and one 10,000-ampere toggle-joint switch, is connected in the negative lead, which connects to the negative side of the battery through a 12,000-ampere automatic overload battery circuit-breaker and two knife switches, one for each section of the battery. The starter was shown in Mr. Shover's article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 3, page 611, Fig. 3.

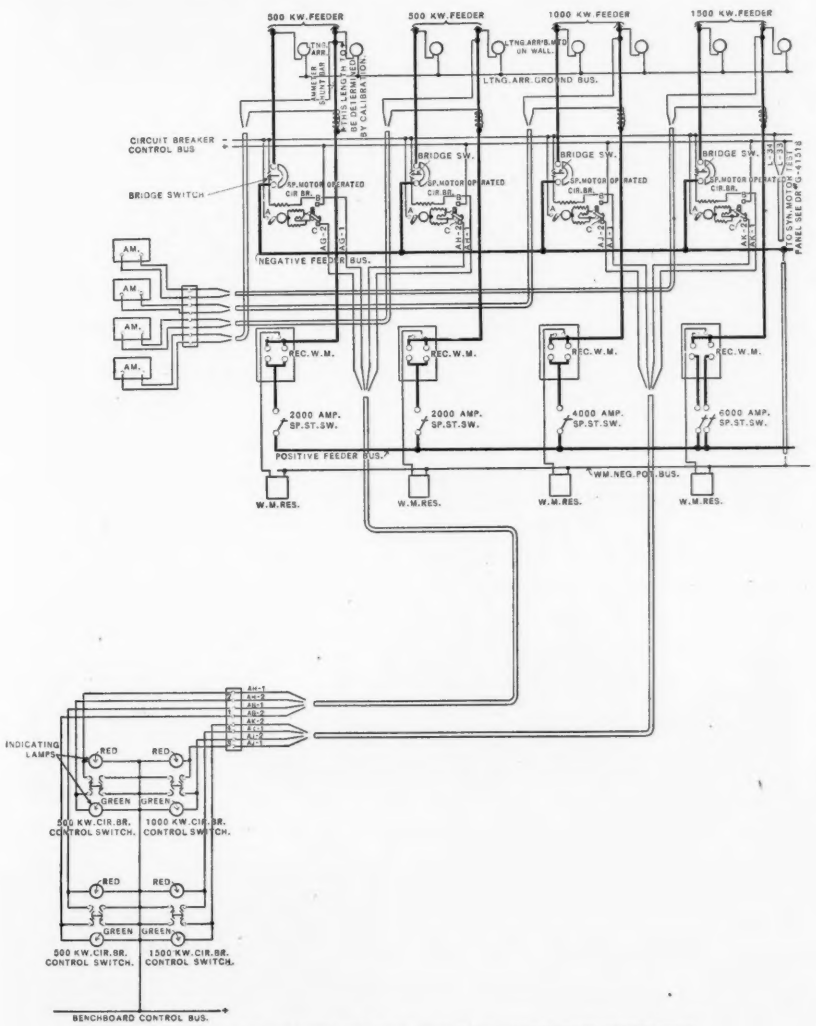


FIG. 11.—WIRING DIAGRAM FOR DIRECT-CURRENT FEEDERS.

Before energizing the starting contactors the starting circuit-breaker must be closed. The closing of the first contactor automatically closes the second, and so on until the last contactor energizes and closes the 10,000-ampere toggle-type contactor switch. When this is done the rotary is synchronized and connected to the main alternating-current busbars by means of the electrically-operated oil switches. These switches are provided with pallet switches, which, when closing the oil switch, will energize a low-voltage release on the starting circuit-breaker and trip the same. When this is done the rotary is paralleled and the automatic running circuit-breaker closed. Should the rotary reach a dangerous speed or should the voltage drop down too low, the circuit-breaker will open, which is also the case if the oil circuit-breaker on the high-tension side is opened. The control switches for the running and starting-breakers are mechanically interlocked, preventing the running circuit-breaker to be closed when the starter is open, and it furthermore makes it necessary to trip the running-breaker before the starter can be open.

The split-pole rotary converter is provided with two field windings, one being excited from the main exciters and the other from a synchronous-motor-driven special synchronous converter. Each alternating-current generator lead is provided with a series transformer, the secondaries of which are connected to current-transformer buses through pallet switches on the oil switches when these are closed. When they are open the transformers are short-circuited. The transformer buses, of which one set is provided for each set of main busbars, are connected through series paralleling switches to three totalizing compensator transformers, which in turn are connected to the alternating-current side of the synchronous converter. The auxiliary field-excitation current for the rotary is taken from the direct-current side of this converter. When stations No. 2 and No. 3 are tied together the battery will regulate on both, but if the stations are not operated in parallel, no regulation is possible in station No. 2, the regulating transformers in this station being short-circuited.

The synchronous motor driving the synchronous converter is started by means of auto-transformers, the necessary switches connecting the motor to three taps on the transformers.

The storage battery, the rotary converter and the booster switchboards are located in front of generator No. 1 and directly underneath the direct-current feeder switchboard. Like this the set consists of two boards and contains all the motor-operated circuit-breakers, knife switches, etc., for the control of the above machinery. The copper connections consist of bars supported on brackets on the rear of the boards from which they run through the basement to the rotary converters, the boosters and the storage battery.

The automatic starters are equipped with separate closing and opening coils and are of the multiple-contactor type, provided with magnetic blowouts. The first contactor is energized by the closing of the control switch on the benchboard, and when this contactor is closed it in turn energizes and closes the second, and so on, until the last contactor cuts out the last section of the resistance, which is indicated on the benchboard by a signal lamp. The time taken for closing the contactors is governed by a series relay located on the starter proper.

All oil switches, circuit-breakers, starters, etc., are remote controlled from benchboards located on the gallery, as

shown in Fig. 12. The benchboards are divided in various sections so as to facilitate the operation of the plant.

Each board consists of a substantial frame construction with Monson Maine slate panels upon which are mounted the instruments, the control switches and the indicating lamps. The sides and rear of the board consist of removable sheet-steel sections. Easy access to the interior of the board is obtained by removing the sheet-steel doors. Between the instrument panels and the control-switch panels there is a large open space which gives the operator a good view of the station.

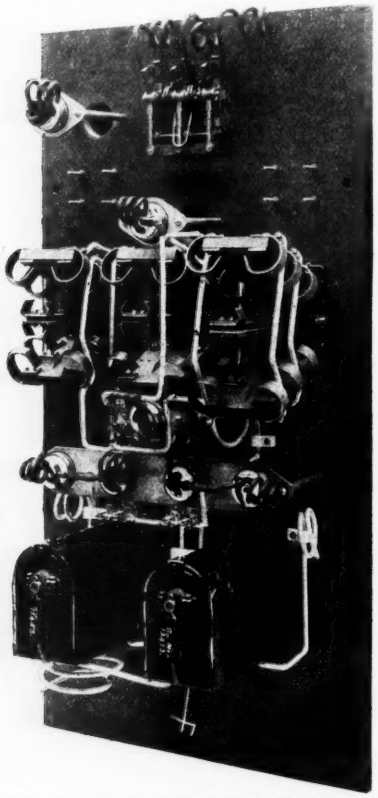


FIG. 13.—REAR VIEW OF ALTERNATING-CURRENT GENERATOR CONTROL PANEL.

The small wiring is mounted on the interior of the board and terminates at test panels, to which also is connected the wiring from the various oil switches, circuit-breakers, instrument transformers, etc., in the stations. These test panels afford an easy means for testing every circuit without breaking the wiring. Fig. 13 shows the rear view of one generator bench panel upon which are mounted the control switches, indicating lamps and synchronizing receptacles.

Each alternating-current generator panel is equipped with three alternating-current ammeters, one three-phase indicating wattmeter, one field ammeter, one voltmeter and one three-phase integrating wattmeter. Each alternating-current feeder panel is provided with three ammeters and one three-phase integrating wattmeter. The synchronous-motor panels have one voltmeter, one three-phase indicating wattmeter and one three-phase integrating wattmeter. Each exciter and direct-current generator is equipped with one voltmeter and one ammeter, while each direct-current feeder is provided with one ammeter.

The generator control switches are of the drum type, provided with attachments for the automatic synchronizer, while the control switches for the feeders and all auxiliary apparatus are of a special double-break construction, as shown in the middle of Fig. 13. The mechanical interlocking device between two generator-control switches is shown in Fig. 14.

The control wiring between the benchboards and the various oil switches, circuit-breakers, etc., consists of No. 6 to No. 12 B. & S. double-braid rubber-covered wires installed in electroduct conduit.

For the station lighting both arc lamps and incandescent lamps are installed. Current for the arc lamps is taken from the 250-volt, direct-current system, while the incandescent lamps are fed from the 6,600-volt, alternating-current system through step-down transformers.

The Western Electric Company, of Chicago, has furnished the complete switchboard equipment for this large plant.

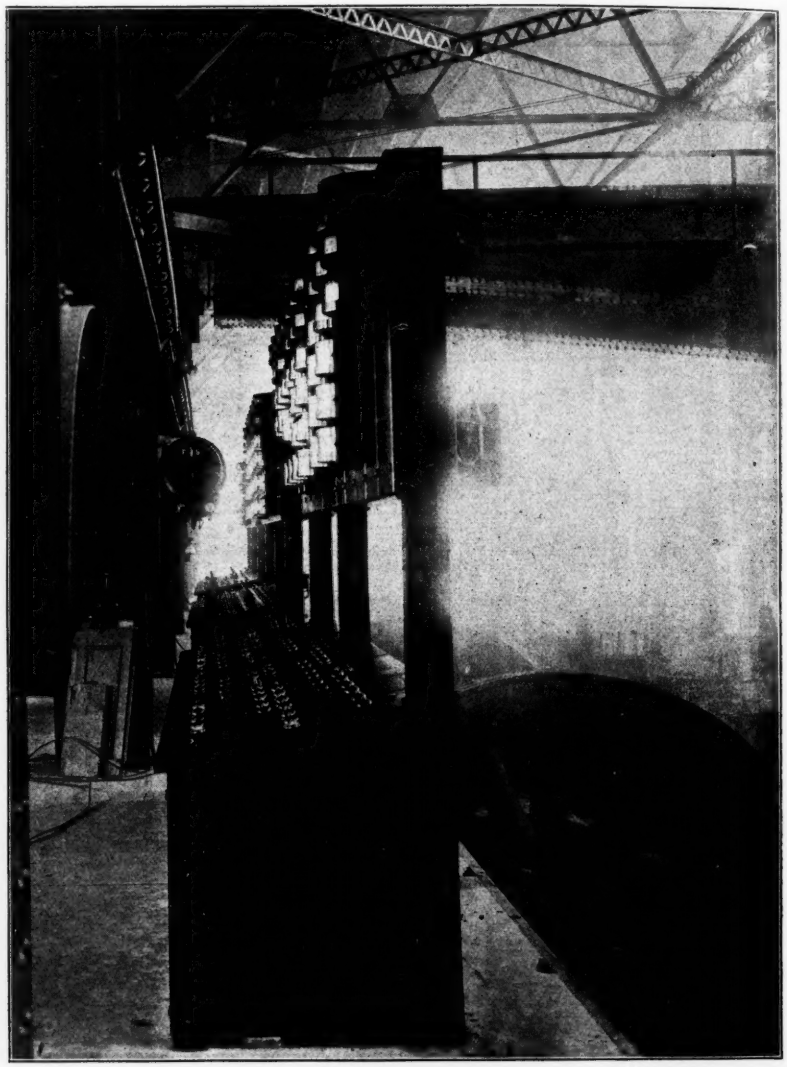


FIG. 12.—REMOTE-CONTROL BENCHBOARDS IN GALLERY.

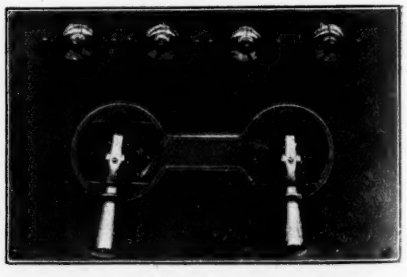


FIG. 14.—MECHANICAL INTERLOCK FOR DRUM-TYPE CONTROL SWITCHES.

THE SELF-CIRCULATING GIN FURNACE FOR THE ELECTRIC MANUFACTURE OF STEEL.[1]

BY GUSTAVE GIN.

I. THE GIN INDUCTION FURNACE.

In induction furnaces, with uncovered canal, it is difficult to get uniform distribution of the heat and of the refining reactions, because of the small heat conductivity and slow diffusibility of the melted material. Much improved results are obtained by securing a continual circulation of the melted matter, which mixes all parts thoroughly and renews continually the reacting surfaces.

This object has been attained by

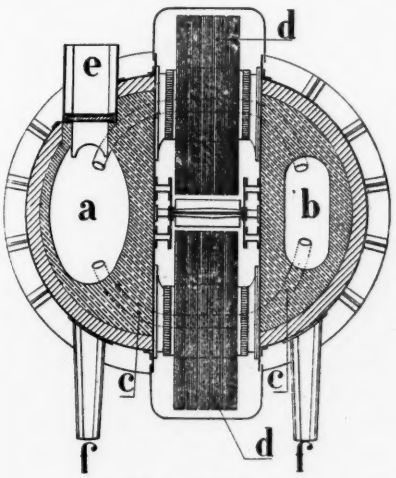


FIG. 1.—PLAN.

Schneider in the furnace described in his U. S. patent 761,920, and by Gin in his U. S. patent 875,801. Our furnaces contain receptacles for the metal alternately in sumps and narrow passages connecting these, inclined and completely filled with metal. The whole forms a closed circuit in which the ascensional movement in the inclined connecting passages produces a continuous circulation of the entire liquid charge. Figs. 1 to 4 show the furnace which we have worked out with the firm of Schneider & Company, and which has been constructed at Essen, Germany, by the Gesellschaft Friedrich Krupp.

The furnace has two principal receptacles, *a* and *b*, united by the heating canals *c*. The vessel *a* is larger than *b*, and is called the working bath; it carries a tap door *e* for slag and a tap hole *f* for steel. The induction bobbins *d* surround the two heating conduits *c*, and are cooled by forced ventilation. The whole furnace is mounted on an axle, so as to tilt it for running off slag and metal.

It is easily seen why this form of furnace gives better results than an uncovered-canal induction furnace. The heating is uniform in all parts of the furnace, and a very high temperature can be attained without fear of the "pinch" phenomenon in the heating passages. All parts of the melt come quickly and rapidly into contact with oxidizing slag, giving quicker refining. The velocity of circulation in the filled canals varies according to their inclination and diameter, but is so arranged as to be at least forty centimetres per second.

It is known that in induction furnaces with annular canals the coefficients of self-induction and of mutual induction increase with the size of the secondary circuit and with the power of the furnace, necessitating diminishing the frequency of the inducing current, and leading to generators and inductors of enormous dimensions, weight and cost. With the self-circulating furnace under discussion, the ohmic resistance of the circuit may be increased without simultaneously exaggerating the self-induction or mutual induction, permitting the operation of furnaces with satisfactory power-factor with generators and transformers of normal frequency, weight and price.

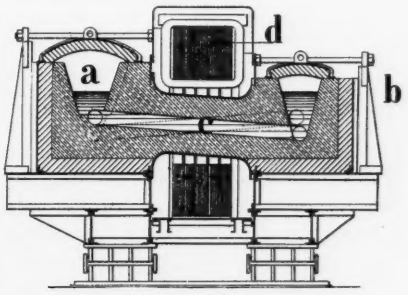


FIG. 2.—CROSS-SECTION a b.

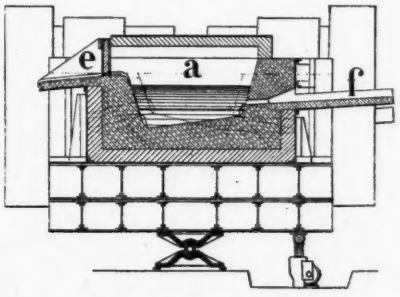


FIG. 3.—SECTION ON a e.

The furnace shown in Figs. 1 to 4 is constructed for 420 kilowatts. The primary current is at 4,800 volts, frequency five periods per second. The metal cast is five tons per heat.

II. GIN ELECTRODE FURNACE WITH SELF-CIRCULATION.

In one type of electric steel furnaces, electric arcs pass from one or more electrodes to the bath that is to be electrically heated.

If the current passes from two movable electrodes to the bath as an intermediary, supporting two arcs in series, the heating is very superficial, heating the slag to a high temperature, but heating incompletely and non-uniformly the bath of metal.

If the current from a single electrode passes to the bath and then away from it by a simple conductor, there is heat developed in the metal proportional to the electric resistance of the mass thus traversed by the current. But with melted iron, a relatively good conductor,

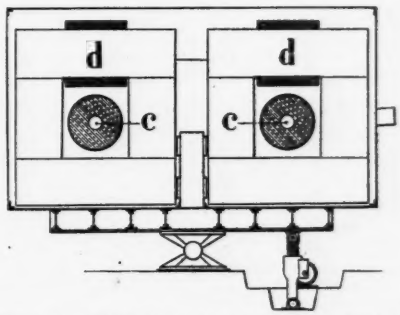


FIG. 4.—SECTIONS ON THE INDUCTION CORES, d d.

this quantity of heat is practically negligible, and the useful effect is again reduced to the superficial heating produced by the arc jumping to the surface of the bath.

In both the above cases the heating is defective and the thermal efficiency low, for the heat conductivity of liquids is small, and one can use for heat circulation in them only those currents produced by sub-surface heating of the deeper parts of the bath. We make use of this principle in our induction furnace by the inclined canals entirely filled with metal, which are entirely submerged. The same principle can be utilized in an electrode furnace.

The simplest application is shown in Figs. 5, 6 and 7, in which the furnace has two reservoirs *a*, united by the tubes *b*, inclined in opposite directions. The electrodes *c* are in communication with the two reservoirs *a*. The current passes through the tubes *b*, causing heating and

[1] A paper presented at the fifteenth general meeting of the American Electrochemical Society, Niagara Falls, Canada, May 6-8, 1909. Translated by Joseph W. Richards.

circulation beneath the surface, and from one reservoir to the other.

In similar manner, a furnace can be operated on a tri-phase circuit, by uniting three reservoirs, by inclined heating and circulating canals, the metal circulating continuously in one direction. Electrically, the electrodes and the canals form a triangular group, in which the charge on each phase can be regulated

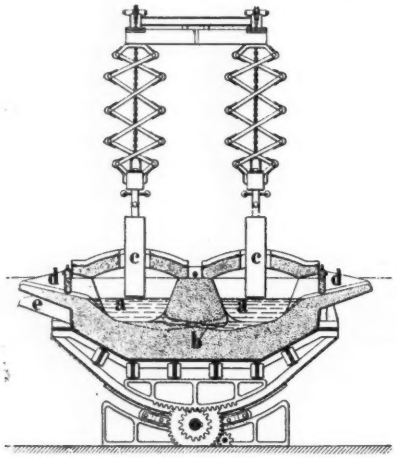


FIG. 5.

by raising or lowering each of the electrodes.

We have worked out the details of furnaces on this system for 750, 1,500 and 2,500 kilowatts, furnishing at a cast eight, fourteen or twenty tons of steel.

III. GIN COMBINED SELF-CIRCULATING INDUCTION AND ELECTRODE FURNACE.

It may be expedient to combine the electrode and induction heating when making steel from materials carrying

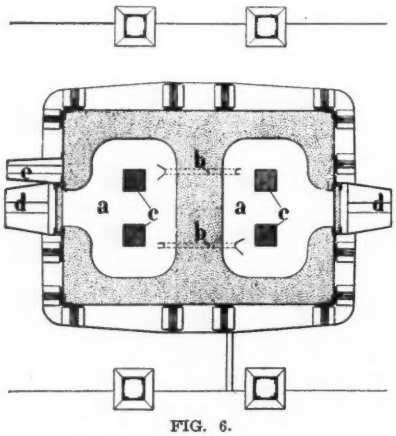


FIG. 6.

much impurity. In such case the large amount of slag covering the bath offers a large electric resistance, and if the heating is by induction only, the heat is developed almost entirely in the metal, and the slag is insufficiently heated for keeping it properly fluid and active. To remedy this, the slag may be otherwise heated by some supplementary means.

In the French patent 339,010 of the Société Schneider & Cie., one or several pairs of electrodes are shown dipping into the laboratory of the furnace and furnishing additional heating by arcs passing between these electrodes or between them and the bath.

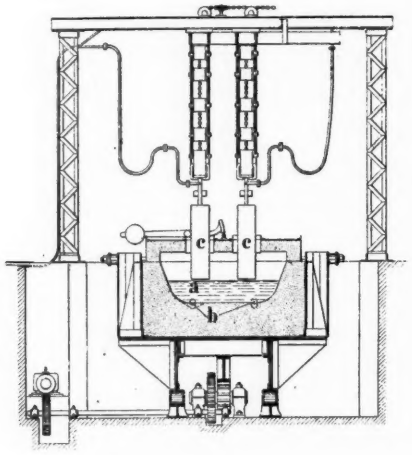


FIG. 7.

In the German patent application, D. R. P. 22,716, of the Roechlingsche Eisen und Stahlwerke zu Rodenhauser, is described the superposing upon the electromagnetic system of an induction furnace of a special secondary winding, which allows sending into the fused bath a second current, by the use of electrodes embedded in the walls of the furnace.

The two inventions above give an insufficient practical result, for they do not allow for or permit the simultaneous regulation of the principal heating current and of the supplementary heating current. A mixed furnace giving a much

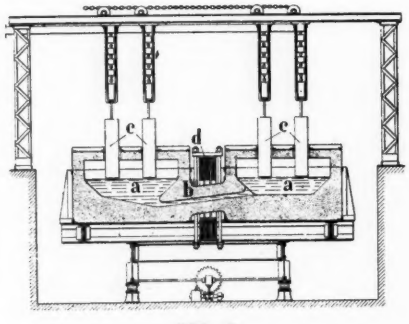


FIG. 8.

more satisfactory effect in practice has two reservoirs, united by tubular canals, inclined in opposite directions. Around one of these canals is an induction system carrying a primary winding and a secondary winding, whose terminals are connected to two electrodes leading the induced current to the surface of the bath in one of these reservoirs. On the other hand, like in an ordinary induction furnace, one has the two reservoirs, with their connecting canals, forming a secondary circuit. There results the internal heating in the body of the metal and superficial heating at the surface in the second reservoir. The electrodes being adjustable, one can, moreover, vary the resistance of the circuit and thus distribute the total electric energy in such manner as is convenient or desirable, be-

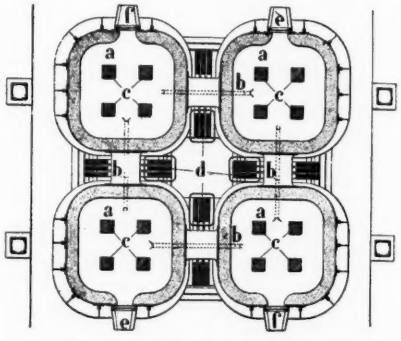


FIG. 9.

tween the two secondary heating systems. This is an important advantage.

One can place a pair of electrodes in one reservoir, or one electrode in each reservoir. The furnace shown in Figs. 8-10 has been designed for 6,000 kilowatts, and to furnish fifty tons of metal per cast.

New Charge on Telegrams in Massachusetts.

A recently enacted Massachusetts bill requires that the time of sending

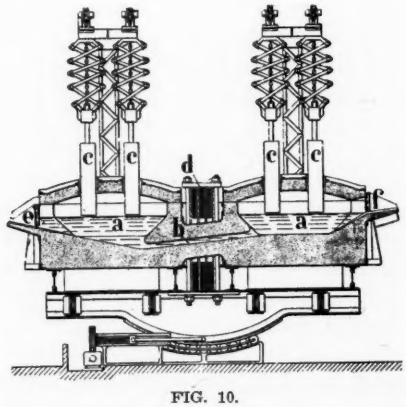


FIG. 10.

and receipt of telegrams shall appear in each message sent and received. The two telegraph companies announce that the additional words and figures required will be counted as a part of each message transmitted.

The Manufacture of Saltpeter from the Air by the Process of the Badische Anilin & Soda Fabrik.

An address on the manufacture of saltpeter from the air by the process of the Badische Anilin & Soda Fabrik was delivered by Dr. Schoenherr before the Elektrotechnische Verein on January 18, 1909, and an abstract published in the *Elektrotechnische Zeitschrift,* Berlin, April 22 and 29. The history of this development is briefly traced and the theoretical basis for the artificial fixation of atmospheric nitrogen by intense heating and following rapid cooling, and the various proposals made for this purpose, especially those involving the use of electrical discharges, are discussed.

"A healthy basis for burning nitrogen by the electric arc on an industrial scale was created only when Birkeland and Eyde succeeded in obtaining a good yield with an arc of great current intensity," said the author. "They utilize the property of a magnet to repel an arc in the same manner as any other movable conductor. Their furnace is a brick-lined, box-shaped hollow space, into which water-cooled copper electrodes project on the narrow sides. The lines of force of an electromagnet arranged outside of the furnace exert their influence vertically to the plane of the furnace. An alternating-current arc started between the electrodes will consequently be blown out alternately toward the top and the bottom. In this simple manner the Norwegian inventors created an extraordinarily effective apparatus for burning nitrogen, and the process is already applied in a 30,000-horsepower factory at Notodden, in Norway.

"Experiments for the artificial production of saltpeter have also been carried on by the Badische Anilin & Soda Fabrik at Ludwigshafen, on the Rhine, since the end of the nineties, and in 1905 I succeeded in inventing a method of burning nitrogen, which employs a still simpler apparatus than the magnet furnace. While heretofore it has been considered of advantage to have the arc burn intermittently or perform exceedingly rapid vibrations through the air to be treated, or to have both things occur simultaneously, the process of the Badische Anilin & Soda Fabrik employs, on the contrary, an arc of great current intensity that burns perfectly quiet and stable.

"This is an arc of a peculiar kind. In working on the problem of burning nitrogen I had observed that it is quite impossible to send large quantities diagonally through an arc, for in this manner only a small part of the air came under the influence of the arc, and the result was the production of very dilute gases. Highly concentrated gases are obtained, on the other hand, if the air is conducted closely along a quietly burning arc. This is more difficult than may appear. A free-burning arc is very sensitive and is extinguished by the slightest cause, even if all air currents from the side are believed to have been prevented. But if a high efficiency is to be attained, considerable quantities of the air must be brought in contact with the arc—that is, high air velocities must be employed, which means danger of extinguishing the arc. Furthermore, unsteadiness is inherent to the nature of the alternating-current arc, which is the only one deserving to be considered in the present development of the electrical industry. The pulsations of an alternating current cause such powerful disturbances in a regular air current that it would seem impossible to solve this question satisfactorily. It is much easier to maintain a direct-current arc, but by the use of an artifice all difficulties can also be overcome with an alternating arc; namely, if the air is not conducted along the arc in a straight line, but in the form of a whirl, that is, in a spiral direction, the alternating-current arc loses its unsteadiness and burns as steadily as a candle flame, and it can be enclosed in quite a narrow metal tube without touching its walls. An arc along which the air is conducted in a straight line has a tendency to strike the walls prematurely and can therefore not be enclosed easily in a metal tube. The employment of non-conducting tubes entails certain inconveniences. In practice, therefore, this company employs exclusively arcs that burn in the center of a column of whirling air. The apparatus itself is very simple. It is only necessary to arrange an electrode in the center of a tube and insulated from the same, to conduct the air through the tube in a spiral direction, and to start the arc in any manner. A simple way of doing this is to make the space between the insulated electrode and the wall of the tube so small that the arc will jump across it freely under the tension prevailing in the circuit. The air current will then drive the end of the arc first formed along the wall of the tube, and a long arc burning steadily in the center of the tube will result, which will terminate only at a considerable distance from the insulated electrode; namely, where the gases have become so hot that they are sufficiently conducting to permit the arc to pass. As an inductive resistance is always connected in the circuit the tension falls by such an amount, when the arc is burning, that its further passage at the narrow starting place need not be apprehended. If the arc should be extinguished by any cause, it will be started again automatically. This method of starting the arc is illustrated in Fig. 1, which is a diagram of the furnaces in use. Z is the starting lever, by means of which a solid iron rod can be moved from the wall of the tube, which serves temporarily as second electrode, into contact with the insulated electrode E. As the entire furnace casing, with the exception of the central electrode, is grounded, there is no danger to the operator in starting the arc.

"The simplest way of producing the whirling motion of the air is to make it flow into the tube in a tangential direction. If the air enters the tube through a single opening, it will flow through the same in the form of a single spiral and will force the arc somewhat to the side, as may be seen from Fig. 2. In the large industrial furnaces the arc burns in a perfectly straight line, as the air flows into them through several rows of such tangential holes arranged over each other. By means of a shutter, S (Fig. 1), which slides over the holes, the length of the arc may be made to vary, while still using the same quantity of air, and it is thus possible to change the load on the furnaces within wide limits and still maintain approximately the same concentration of the nitric oxides.

"The installation at Ludwigshafen permitted the use of only 300 kilowatts, and therefore an experimental factory was erected in 1907 in Kristianssand, in Southern Norway, in order to test the furnaces for longer periods and with larger amounts of energy. Three furnaces of 600 horsepower each have been in operation there for over a year with currents of 7,200 volts. Furnaces of 1,000 horsepower have also been used intermittently, and the future factories are to be equipped with this type only. It is even considered possible to construct furnaces of 2,000 horsepower with equally good success.

"The construction of the present furnaces is shown in Fig. 1. In the center is the electrode, insulated from the rest of the furnace. It consists of a water-

cooled copper body, in the middle of which an iron rod E is movably arranged. This iron rod forms the real electrode, from which the arc issues, and is the only part that is consumed. The wear is very small and the costs for electrodes therefore amount to only a few

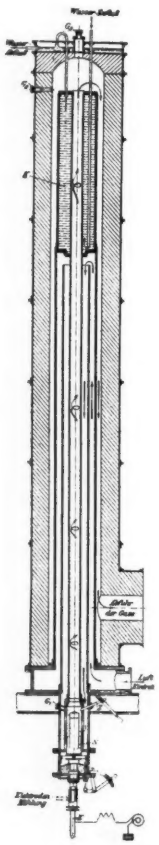


FIG. 1.—DIAGRAM OF FURNACE USED BY THE BADISCHE ANILIN UND SODA FABRIK.

cents per kilowatt per year. The rod Z, already referred to, serves for starting the arc. A window G_1 in the lower part of the furnace permits observation of the starting point of the arc, so that the iron electrode may be fed in at the proper time. Of course, this may also be done automatically.

"The arc in the 600-horsepower furnaces is about five metres long, and in the 1,000-horsepower furnaces, which are operated under a higher pressure, it attains a length of even seven metres. The surrounding tube is a simple iron cylinder. As the arc touches it only quite temporarily upon starting, its life is almost unlimited. The upper part of the tube is developed into a special cooler. By a suitable adjustment of the air-regulating slide the arc is driven up to this point. This may be observed through two windows, G_2 and G_3. The upper end of the arc is continually changing its position, so that it touches a large surface of the cooler, making the wear on the latter very slight. The cooler can also be readily exchanged.

"After passing the cooler the hot gases flow downward into a brick-lined channel concentrically surrounding the inner parts of the furnace, and then into a steam boiler, which serves as a further cooler for the gases, and the steam from which is used for the concentration of the solutions produced in the process.

"The vertical arrangement of the arc is not essential, furnaces with a horizontal arc having also been used, in which the flame burnt steadily in the center of the tube. By means of the whirling motion of the air it is also possible to make the arc pass around bends in the tube, and thus to make it still longer, if desired.

"As regards the efficiency of the process, it must be confessed that it is quite low, since only about three per cent of the total energy supplied to the arc is utilized in the actual formation of the nitric oxide. It is true that besides the oxide a quantity of highly heated air is produced, but the energy contained in the same is utilized only to a small degree. The heat in our furnaces is accounted for approximately as follows: Forty per cent of the heat supplied to the arc is obtained in hot water, seventeen per cent is lost by radiation, thirty per cent is utilized in the steam boiler, ten per cent has to be abstracted from the gases by cooling with cold water after they have passed the boiler, while three per cent serve for the actual formation of the nitric oxide. The heat transferred to the water and steam may be utilized in other ways, so that no other source of heat besides electrical energy is required in the manufacturing process.

"From this general description it will be seen that the process is very simple. The furnaces are simple, cheap, safe in operation and have a long life. They contain no moving parts or expensive electromagnets and permit the employment of large units with excellent efficiency. The process also furnishes nitric oxide of much higher concentration than most others, which is very important for the absorption."

The author then refers to various methods of absorption, naming their advantages and drawbacks. The company has recently succeeded in producing a calcium nitrite containing eighteen per cent of nitrogen, while Chili saltpeter contains only about fifteen per cent, and the product manufactured by the Birkeland and Eyde process thirteen per cent. Of course, the industry is not limited to the manufacture of saltpeter, and in the first place it will rather produce nitric acid, which has a much greater value. But the manufacture of saltpeter must form the basis of the new industry, for only if this proves profitable can it look to the future with confidence.

In conclusion, the combination entered into by the Badische Anilin & Soda Fabrik and the Norwegian Hydro-Electric Nitrate Company, owner of the Birkeland and Eyde patents, is referred to. The latter found it to its interest to secure the process of the German company, which, in turn, expected to obtain special advantages from the waterpower concessions owned by the former. The first common factory will be that being erected on the Rjukan River, which will have a capacity of 250,000 electrical horsepower, and where the new process will be applied. This establishment is expected to be in operation in 1910. Waterpowers have also been secured in Western Norway, where saltpeter will likewise be manufactured, and upon the execution of these projects over 400,000 horsepower will be in the service of the new industry in Norway.

FIG. 2.—SHOWING THE ARC MOVED TO THE SIDE BY THE AIR SPIRAL.

$1,000 "Ozone" Scholarship.

Governor Stubbs, of Kansas, has established an ozone scholarship at the Kansas State University. The fellowship is for $1,000 a year and provides that the student is to devote his entire time to the investigation of ozone and find practical uses for it.

Coal for Hand-Fired Steam Plants.[1]

Steam is being generated in all parts of the country with the coals which are mined near by, or which are available at a reasonable freight rate. Some engineers are burning coals which others would consider as impossible fuel for their plants.

It is generally known that there is a difference in the character and heating value of the coals mined in the United States, and yet very few people realize how great these variations are.

Much coal is left in the mines of West Virginia and Pennsylvania as being of such low grade that it will not pay to market it. This so-called low-grade coal is, however, but little less valuable than the regular output of the mines, and is, in many cases, much better than the best coal mined in the states farther west.

Preference is naturally given to those coals which have a small percentage of ash and do not clinker badly, and to the larger sizes such as lump or egg.

The Technologic Branch of the United States Geological Survey has been conducting tests on all the fuels of the country and many valuable facts have been established regarding their character and the best methods of utilizing them.

To show the differences in coal mines in the United States the following table has been prepared from results taken from Professional Paper No. 48 of the United States Geological Survey:

TABLE I.

Coals Tested on a Hand-Fired Grate Under a 210-Horsepower Heine Boiler.

	Analysis of Coals as Fired.					Coal Moisture and Ash Free.		
	Fixed Carbon.	Volatile Matter.	Moisture.	Ash.	B. T. U.	Fixed Carbon.	Volatile Matter.	B. T. U.
West Virginia—6..	70.03	22.38	2.14	5.45	14,639	75.78	24.22	15,841
Pennsylvania—4....	60.82	28.70	2.90	7.58	13,982	67.94	32.06	15,619
Arkansas—1.....	66.36	18.61	1.99	13.04	13,302	78.10	21.90	15,654
Kansas—3.....	50.99	33.52	2.03	13.46	12,746	60.40	39.60	15,082
Kentucky—3.....	44.84	37.32	7.92	9.92	12,003	54.58	45.42	14,609
Alabama—2.....	48.65	32.98	4.83	13.54	11,948	59.60	40.40	14,638
Illinois—1.....	38.21	36.91	9.69	15.19	10,706	50.86	49.14	14,252
New Mexico—2....	36.11	37.30	9.92	16.67	10,330	49.19	50.81	14,070
Missouri—2.....	37.33	32.88	13.09	16.70	9,995	53.17	46.83	14,234
Wyoming—1.....	31.61	40.56	21.81	6.02	9,630	43.80	56.20	13,343
North Dakota—1..	25.40	28.13	35.84	10.63	6,674	47.45	52.55	12,466

For a range of volatile matter between eighteen and forty per cent, the efficiency varies about twelve per cent in favor of the low volatile coals.

On tests with a Heine boiler, hand-fired, this variation is only about six per cent owing to the better methods of firing and to a better type of furnace. It is probable that a furnace may be designed to burn high volatile coals with practically the same efficiency as is obtainable with the low volatile coals.

TABLE II.

The Relation of Volatile Matter in Coal to Efficiency of House Boilers.

Number of Tests Averaged.	Volatile Matter in the Combustible, Per Cent.	Efficiency, Per Cent.	Per Cent Rated Capacity Developed.	Black Smoke, Per Cent.	Ash in Dry Coal, Per Cent.	Sulphur in Dry Coal, Per Cent.	Clinker, Per Cent.	Per Cent CO_2 in Dry Flue Gases.	Per Cent CO in Dry Flue Gases.
4.....	18.30	60.56	63.7	18.2	8.00	1.33	.0	8.7	.44
12.....	22.71	56.33	61.1	18.0	8.94	1.74	.0	7.3	.50
7.....	35.70	54.11	52.8	22.1	11.27	1.23	2.9	7.4	.55
11.....	38.79	47.19	57.1	30.8	15.02	2.64	12.0	8.7	.62
16.....	44.46	47.19	61.3	32.9	14.57	4.35	30.4	9.1	.74

Experience in burning coals from all sections of the country in a hand-fired furnace indicates that for such an equipment the size of the coal is not of as much importance as is usually thought to be the case, but the smaller sizes require more draft and are slightly less efficient.

Nor does the ash affect the results as much as might be expected. Small variations in the percentage of ash seem to have but little effect except in so far as the heating value of the coal is varied.

Owing to the fact that the moisture, ash and volatile matter usually increase together in the poorer coals, it is difficult to separate the effects of any one of them from the other. The following table seems to indicate, however, that the larger percentages of volatile matter make the coal more difficult to burn completely. The moisture and ash also have an influence on the results.

These tests on house boilers show that for wide ranges of volatile matter there is a considerable difference in the results. These are significant, as they were obtained on a type of furnace which is most unfavorable to perfect combustion, and therefore make the effect of the composition of the coal more marked.

To show the relative amounts of coals and their constituents that must be fed into a furnace to furnish it with one million British thermal units, the following table has been prepared:

This is a more convenient basis of comparison than the analysis which is usually given.

However, this does not give an entirely correct comparison for the reason that not all of the heat as reported in the British thermal unit values is available to the boiler. The percentage of available heat varies with moisture and other constituents of the coals. These values, if calculated, would compare with the so-called low values used for gases and in some cases for liquid fuels. As there is at present no accepted standard for determining the corrections to the heating values of coals for boiler use, the above table has been submitted without an attempt to correct values.

As the result of over 400 tests it has been noted that in general the evaporation has been nearly in proportion to the heating value of the coals. In some cases the coals of higher heating value did not give as high results as others of lower heating value. This may be due to either of two causes. The composition or size of the coal may be such as to make it difficult to burn it all completely, or the method of firing and the air supply may have been at fault.

For an average the results depend principally on the heating value of the coal when the coal is burned in a properly constructed furnace. Of course, the moisture, the ash and the volatile matter influence the efficiency. And ash in larger amounts, especially if it tends to clinker, reduces the capacity at which an equipment may be operated.

It must be understood, too, that not all of the heating value of the coals, as determined by the calorimeter, can be made available to the boiler. The moisture in coal requires considerable heat to evaporate in the furnace. This varies from about one-half per cent of the fuel value in good eastern coal to about one-and-one-fourth per cent for Illinois coal and to about five to eight per cent for the lignites.

The most simple furnace and the one least suited to burn bituminous coal is the hand-fired grate with a small combustion space bounded principally by iron surfaces. This furnace is found in house boilers and locomotive types. The best furnace for most coals is one which is so designed that the coal is fed regularly in small quantities; air is admitted to the gases, which are slowly driven from the coal, and combustion takes place in a large combustion chamber, which allows the gases to burn before they reach the cold surfaces of the boiler tubes.

Time is required for the gases and air

[1] A paper (slightly condensed) written by D. T. Randall, until recently engineer in charge of tests, Technologic Branch, United States Geological Survey, and read before the convention of the American Waterworks Association at Milwaukee, Wis., June 8 to 12, 1909, by S. B. Flagg of the United States Geological Survey.

to burn, and any means that will cause them to mix quickly will reduce the size of combustion chamber required to secure economy and smokeless combustion. A perfect furnace would burn all coals with equal efficiency. The ordinary hand-fired furnace found in most plants is far from being a perfect furnace.

One should choose a coal suited to the furnace and boiler equipment or else change the furnace to meet the requirements for a cheaper coal. A strong draft is an important condition to be secured in a boiler plant. A tall stack is a good investment. Stacks should seldom be less than 120 feet high. In many cases they should be higher. A fan may be used with a shorter stack with good results. In many cases coals have been pronounced as unsatisfactory because the draft was too low.

In considering coal for boiler plants, it is necessary to know the coals which are available and their relative values. Some otherwise good coals may be unsuited because of trouble from clinker. Not always, but generally, the cheapest coal to buy is the lower priced one, provided conditions in the plant will permit its use.

In order to compare the cost of coals offered to the Government they have been calculated on the basis of the cost of 1,000,000 heat units delivered. This varies from seven to twenty cents in different parts of the country. If the purchaser desires assurance that the same coal which he selects shall be delivered throughout the contract period, he naturally desires to make use of specifications covering the essential characteristics of the coal. The United States Government, many state and city governments, and numerous commercial firms are now using such specifications with success. The specifications cover such items as price, method and time of delivery, and also establish a standard for the heating value of the coal, and the ash content. In some cases the permissible amount of volatile matter is stated. These points are of high value in the purchase of coal in order that the purchaser may get what he pays for and pay for what he gets.

The experiments of the Technologic Branch show that for almost any character of coal furnaces may be adapted or new ones designed which will burn them with reasonable efficiency and that almost no fuel need be rejected as worthless. Even coals of small sizes and high in ash may be so prepared that when properly sized they will give results that are but little below those for the larger sized and better coals.

TABLE III.

Comparison of Coals in Table I on Basis of Amounts Required to Supply One Million British Thermal Units to Furnace.

	Pounds Coal per Million B. T. U.	Pounds Fixed Carbon per Million B. T. U.	Pounds Volatile Matter per Million B. T. U.	Pounds Moisture per Million B. T. U.	Pounds Ash per Million B. T. U.
West Virginia—6...	68.31	47.84	15.29	1.46	3.72
Pennsylvania—4.....	71.52	43.50	20.53	2.07	5.42
Arkansas—1.....	75.17	49.88	13.99	1.49	9.80
Kansas—3.....	78.45	40.00	26.30	1.59	10.56
Kentucky—3.....	83.31	37.36	31.09	6.60	8.26
Alabama—2.....	83.69	40.71	27.60	4.04	11.33
Illinois—1.....	93.41	35.69	34.47	9.05	14.19
New Mexico—2.....	96.80	34.95	36.10	9.60	16.14
Missouri—2.....	100.06	37.35	32.90	13.09	16.71
Wyoming—1.....	103.84	32.82	42.11	22.65	6.25
North Dakota—1.....	149.83	38.05	42.14	53.70	15.93

Seattle's Lighting Service.

The local and Pacific Coast press generally is devoting considerable attention to Seattle's municipal lighting system and its alleged deficiencies. The principal points brought out are that the city's lighting management shows less ability in the handling of its rates than do the private companies. While the city is cutting rates in order to land some heavy contract downtown, residents in the outlying districts are not supplied with lighting except by private corporations, which, exclusive of the street lighting, control still eighty per cent of the lighting of the city.

Another sore point in the minds of the citizens against the local municipal lighting system is the comparative inefficiency of the employes. The ambition which leads to hard work and faithful service on the part of employes of the private concerns seems to be entirely lacking on the part of the civil-service employes of the department. They feel sure of their jobs and their wages, and the light eight-hour day appeals to them. They are less efficient than the employe of a private concern, who is subject directly to the man in charge of his department.

Yet the city is in the position of having to fight hard for commercial business to steer clear of a deficit, the burden of which would fall on the taxpayers. So the citizens face the alternative of accepting this condition from the city lighting plant or voting more and more bonds or donating from their general fund to permit the city's plant to give the kind of service needed.

Specific instances of inefficient service and inconsistent rates are cited.

Signaling to Mars.

Buffalo, May 25, 1909.

To THE EDITORS:

I have noticed in the press recently an announcement that a suggestion had been made that, with an expenditure of ten million dollars, communication could be established with the people of Mars.

As a matter of fact, this subject is not a joking matter at all, but a question of scientific research, and I am of the opinion that it can be done by solicitation, without any great expenditure of money, and without any individual assuming any financial obligation in carrying out the work.

It occurred to me several years ago that if the people of Mars are as far advanced in civilization as some scientists have reason to believe, that they are already studying the growth of our cities by noting their illumination at night, and that the easiest, cheapest and best way for us to communicate with them is to light up certain cities after midnight.

In the United States, for instance, we could pick out all the towns that fell on a state line—from which they would get the idea that we were one nation divided into many states.

Another plan would be to pick out such towns as would spell "United States" across our country from New York to San Francisco, or just "America."

Then, if we were answered in some way, the different states could letter themselves, from which they would learn our whole alphabet.

In fact, a number of towns that are lighted by electricity could probably be found in one state in such number and proximity as to be chosen to form any capital letter of the alphabet.

An association of these lighting communities could thus elect to spell our alphabet, giving every letter five minutes and repeating the performance, say every Sunday night, from which they would learn that we observed the seventh day.

I think this idea should be studied and well considered, and that such an association of lighting communities working in conjunction with astronomers with powerful telescopes, could certainly give impetus to the idea and get something started in a practical way.

SAMUEL E. HITT, M. E.

Buffalo, N. Y., June 1.

St. Louis to Improve Its Street Lighting.

Early last fall when preparations were being made by the authorities of the city of St. Louis for the renewal of the street-lighting contracts it was realized that some effort should be made to improve the street-lighting system, especially in the business district, which had been in vogue for the last ten years. In addition to this preparations were being discussed for the proper celebration of the one hundredth birthday of the city, to fall on November 9, 1909, and the first week in October was chosen as the centennial week.

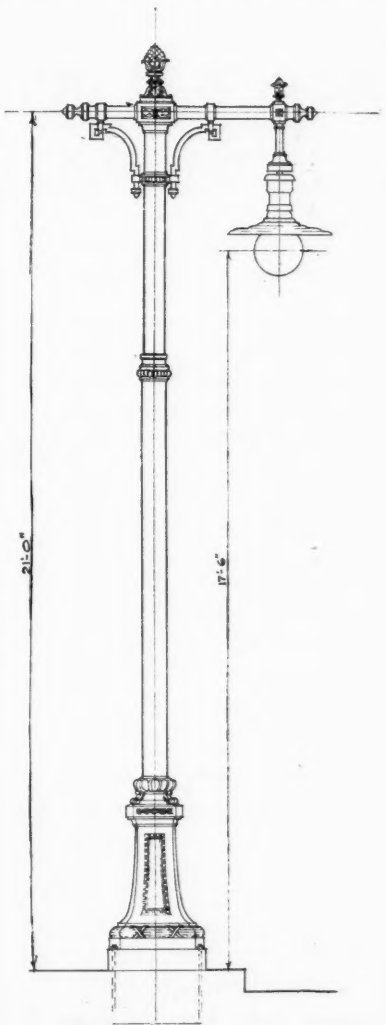
In December of last year a movement was started for improving the street lighting in the business district. With this end in view a voluntary organization, the Down Town Lighting Association, was organized by a group of the larger merchants and property owners in the district. This organization was given a fund for the employment of a secretary and engineers to make the necessary investigations of the different street-lighting systems in vogue in many American cities.

The conclusion reached by the engineers and the committees was that an improved form of arc-lamp system was the best obtainable, and that this should be adopted for St. Louis. An investigation of the different forms of arc lamps was then undertaken, which finally resulted in the recommendation that the association adopt the metallic luminous arc lamp of 220 watts and manufactured by either the General Electric or the Westinghouse company.

This point having been settled, the next question was the designing and adopting of a suitable lamp standard of sufficient height to give the best results. This was left to the engineers, who decided that the standard should be twenty-one feet above the curb line, and that the lamp should be not less than seventeen-and-one-half feet above the street level. The design of standard was left to a group of architects, the one adopted being the work of Frederick M. Mann, of the School of Architecture of Washington University, St. Louis.

With the type of lamp and lamp standard determined upon, their number and location in the business district had yet to be decided. This task was delegated to the engineers of the association—Guido Pantaleoni, H. H. Humphrey, and Will M. Dixon, aided by S. B. Way, superintendent of the electrical department of the Union Electric Light and Power Company, and H. S. Sanderson, supervisor of city lighting. In order to insure the best distribution and the best results for the proposed system the engineers decided to place one of the new lamps on each street corner at all street intersections and two in the middle of each block, one on either side of the street, approximately eighty feet apart.

This location of the lamps placed 470 of the new type in a district where there have been but 138 of the old enclosed-arc type for the last decade. It was felt that this would give the city one of the best lighted business districts in the United States. This district comprises forty square city blocks with a total frontage of approximately 55,000 front feet. No other city in the country has ever attempted the illumination of so large a territory on so large a scale through subscriptions on the part of property owners and merchants to a fund for this purpose.



NEW TYPE OF STREET LAMP, ST. LOUIS, MO.

When the plan of the association had been finally completed it was placed before the Board of Public Improvements of the city of St. Louis for its approval and adoption. This was necessary because the new system was to replace the old and was to be maintained by the city under its public street-lighting contracts with the Union Electric Light and Power Company, and legal authorization for this had to be obtained from the Municipal Assembly of the city.

In the meantime the subscriptions to pay for the system were being obtained by committees of the association. These were being solicited mainly from the property owners and on a basis of $1 per front foot. The fund thus secured is to be used to pay for the 470 ornamental lamp standards which the Union Electric Light and Power Company has agreed to manufacture at cost price. This company also has generously agreed to install them at its own cost and to supply the new lamps. Besides this it will have to make many changes in its station equipment, and this burden it has assumed. The total cost of the improvement will be approximately $55,000 to the property owners and about $100,000 to the Union Electric Light and Power Company.

When the system has been completed it will be turned over to the city of St. Louis as a free gift with the understanding that it be maintained and the current paid for by the city under its lighting contracts. The work of installing the new system will begin during the first week of July, and is to be completed not later than September 15 and in operation on October 3, the first night of the centennial celebration. Practically the entire fund has been secured.

The officers of the Down Town Lighting Association are: Tom W. Bennett, president; Dan C. Nugent, vice-president; Thomas H. West, Jr., treasurer; John E. Tiedeman, secretary. The executive board is composed of Hanford Crawford, president of Scruggs-Vandervoort-Barney Dry Goods Company; Aaron Fuller, vice-president of Stix, Baer & Fuller Dry Goods Company; Dan C. Nugent, president B. Nugent & Brother Dry Goods Company; Lawrence B. Pierce, president Income Leasehold Company, owner of the Pierce Building; Lyman T. Hay, general manager Hotel Jefferson and Planters Hotel; Thomas H. West, Jr., secretary St. Louis Union Trust Company; Tom W. Bennett, president Mortgage Guarantee Company of St. Louis, and Fred G. Zeibig, Cornet & Zeibig, real estate.

Control of Laclede Gas Passes to Syndicate.

Official announcement was made on June 11 that the North American Company's holdings of the common stock of the Laclede Gas Light Company, of St. Louis, have been sold to G. H. Walker & Company, of St. Louis, and William Salomon & Company of New York. It is understood that associated with G. H. Walker & Company are some of the most important financial interests in St. Louis, some of whom are now connected with the management of the company. These local capitalists, who are familiar with the company's affairs, it is pointed out, believe strongly in its future and are desirous of developing it as a local property. It is reported that there will be no change in the management of the company, John I. Beggs remaining as president. Adolphus Busch, of St. Louis, is a member of the syndicate. President Wetmore, of the North American Company, was not disposed to reveal the identity of the buyers or to make any statement as to the consideration involved.

The negotiations which had been pending for several months for the sale of the company to the American Light and Traction Company were recently dropped, and, according to Vice-president L. P. Lathrop of the latter company, his concern is not interested in the sale to Salomon & Company. The Laclede Gas Light Company has an authorized capital stock of $20,000,000, of which $11,000,000 is outstanding. The amount of common stock issued is $8,500,000. Besides Mr. Beggs, the directorate includes the following gentlemen: E. M. Bulkley, George R. Sheldon, C. W. Wetmore, E. G. Cowdery, C. H. Huttig, Breckenridge Jones and Julius S. Walsh.

Delegates to the Wright Brothers Presentation.

On the occasion of the presentation of the gold medals of the Aero Club of America to Wilbur and Orville Wright by President Taft in the East Room of the White House on June 10, the American Institute of Electrical Engineers was officially represented by William J. Hammer at the request of President Ferguson. Mr. Hammer also represented the Aeronautic Society of New York. The Franklin Institute was officially represented on this occasion by Emile Berliner, of Washington, D. C., and Charles Day of Philadelphia. All three of these delegates are members of the Aero Club of America.

Central Stations and the Electric Vehicles.

In connection with the activity with which many central stations are now taking up the question of adding to their power circuits public and private garages for the charging of automobile storage batteries, the half-page advertisement which recently appeared in the *Union Republican* of Adams County, Iowa, is of interest.

The Corning Light, Heat and Power

GOODBYE TO THE HORSE

The Gasoline Car instead of competing with the horse has created a field of its own. If you want a touring car the best made are for sale in Corning

.....BUT.....

The Electric Car is the one to compare directly with the horse—and the horse can't stand the comparison Wherever the Electric is introduced it's "goodbye to the horse."

Hundreds of delightful little tours, excursions and outings, beyond the horse's strength and speed, are always at command if you own an Electric Vehicle. For city traffic or suburb driving it is in a class by itself.

A lady can drive an electric in white suede gloves; she steps from her electric into the theatre, the shop, the house of her friend or into church looking as fresh and exquisitely dainty as when she made her toilette.

No horse can be driven 18 to 20 miles an hour. No horse can go 50 to 60 miles without resting. The electric vehicle can

It's always ready when you want it. It never balks, scares or runs away. A horse may be hard to drive—the electric vehicle is always easy. Children are driving it every day. The electric vehicle, motorcar, carries passengers and freight cheaper than horses can. It's the old story of machinery and progress triumphant. But it's not economy alone that has appealed to the present great army of Electric vehicle users. It's the simplicity the freedom from mechanical vibration and noise. You just get in and go. Fast or slow, it is as easy as turning on an electric light.

What delightful treats lie in store for the friends of that woman who owns an electric. Could there be a better method of paying social scores or setting the pace? Fresh air outings—health and rest for tired nerves. It's the safe, simple, noiseless way for man, woman or child to drive, either for pleasure or business.

The physician can save one-half his time on the road and go twice as far in a day as a horse would take him. So can you. Ladies drive or shop or call with a speed, comfort and safety they never know before. Starts and stops like turning on or off an electric light. No expert driver or mechanic is needed—you are independent of all that. Making your electricity and storing it in your car—that's taken care of by the Electric Light Company, any time you are not using it, usually late at night. It's done either at home, at a garage or at the power house.

Average cost less than $10 per month for pleasure vehicles. Makes 50 to 60 miles a day if you want it. You can jog along or go at an 18 to 20 mile gait.

From $1.50 to $2 per charge will take you 100 miles if you go slow enough or 50 miles if you go 18 miles per hour.

As it seemed there was going to be a demand for Electrics here in Corning we have gone to the expense of fitting up a "Charging Station" and are prepared to not only charge Electrics, but will, for those desiring us to, take the entire responsibility of keeping them in proper running condition. Outside of the battery being properly charged, there is scarcely anything in an Electric to give trouble, and as we have a large storage battery of our own in the plant to care for, we can easily give the smaller ones the proper care. Ask the gasoline men to sell you an electric, and we will take care of it for you. If they don't care to bother with them, we are in a position to give you low prices on them, backed by our personal guarantee.

There are thirteen different makes and we can sell you any one of them, but consider the ones with solid tires the best, as the tire trouble is eliminated and the fact that 90 per cent of the electrics in use in Chicago have solid tires speaks for itself. The cost per month for charging depends on the number of times it is charged, and this depends on the miles you run and the mileage from one charge varies with the speed. The slower you go the longer the charge lasts but when you want to go fast you can do so. We are prepared to make a very low rate for charging, as we expect from indications that the electric is soon to be a common sight in Corning amongst the ladies who desire an auto they can handle themselves. Don't let hill climbing ability bother you. We can convince you that there is nothing in that when the "Exide" storage battery is used and we would advise using no other. We have gone into the Electric Vehicle business very thoroughly the past two months and are prepared to satisfy the most exacting customer that

The Electrics Are Here to Stay

Corning Light, Heat and Power Co.

Company is going after this business with vigor, and its example is worthy of emulation by other central stations. In addition to the advertisement, a reproduction of which is published herewith, the following news item appeared in the current issue of the *Union Republican:*

"Now that automobiling is in the air, it might be well for our readers to post themselves concerning the electric machines mentioned in the large advertisement of the Corning Light, Heat and Power Company, elsewhere in this issue of our paper. Mr. Munns always talks straight business, and he is paying for valuable space in this issue to reach your ears. It is certainly worth reading."

World's Largest Electrically Controlled Switch Tower.

The new Promenade Street block-signal tower of the New York, New Haven & Hartford Railroad at Providence, R. I., the largest electrically controlled switch tower in the world, has been put in service.

The new tower has seventy-seven levers and a capacity of 266 combinations, which can be made with great rapidity and ease. Chances of giving wrong signals are said to be eliminated by mechanical combinations, and wrong combinations for routes are impossible. Three sources of electric power are available, so that either of two can be employed if the usual source, which is the power current of the electric railway, fails. The tower is of concrete and is considered one of the finest of the railroad's buildings in Providence.

Six men, working two at a time in three-hour tricks, will operate the apparatus in the tower.

Ornamental Poles Prize Competition.

The Engineers' Society of Pennsylvania has an established fund to provide prizes for meritorious designs of engineering structures.

At this time prizes are offered for the best design of ornamental poles for the support of lights and trolley wires. Plans, specifications and estimates of cost must be submitted. The competition is to close July 15, when the designs submitted will be opened by the Board of Award. For particular information, address Paul A. Cuenot, chairman, prize committee, Engineers' Society of Pennsylvania, Harrisburg, Pa.

Philadelphia Transit Dispute.

The Philadelphia City Councils have adopted resolutions directing the city solicitor to bring legal proceedings to determine the right of the Philadelphia Transit Company to withdraw from sale the six-for-a-quarter tickets without the consent of the city of Philadelphia. Common Councils, after a debate, also adopted a resolution demanding that the tickets be restored.

George H. Earle, Jr., was elected at a joint meeting of councils to succeed State Senator Clarence Wolf as one of the city's three representatives on the Philadelphia Rapid Transit Board.

Successful Distillation of Turpentine by Electricity.

United States Consul-General Geo. N. West has recently investigated the operation of a small plant in Vancouver in which experiments have been carried on for several years with the view of obtaining turpentine from the resinous woods of British Columbia by an electrical process of distillation. He reviews the progress made as follows:

The operations thus far have been carried on in a small way, only about two cords of wood or mill refuse having been treated daily. It is claimed, however, that the results have been eminently satisfactory. The turpentine, after tests by chemists and painters who have used the product both for inside and outside work, is pronounced to be equal if not superior to the turpentine distilled from the long-leaf pine of the South. From one cord of the resinous wood treated it is claimed that the tar oil, rosin, pitch, and charcoal (the by-products) more than pay the cost of the distillation of the turpentine, thereby making this process a valuable one.

It is claimed that from one cord of pitchy wood costing $5 there can be extracted chemically pure turpentine, tar oil, rosin, charcoal, and pitch to the aggregate value of $24.70, the present market value of these commodities, at an expense of $12, giving returns of $12.70 per cord. That this statement is not erroneous is vouched for by persons who have the most thorough knowledge of the process and cost of manufacture, they claiming that the small plant now in operation is producing the products at the price per cord stated.

The amounts of by-products said to be obtained from one cord of wood (amount of turpentine secured not being stated) are as follows: Rosin, sixty pounds; tar oil, twenty gallons; charcoal, 1,300 pounds. The oil is used for wood preservative, and is also manufactured into shingle stain. The charcoal, having been coked and cooled in a can out of contact with the air, is very perfect and valuable for making powder.

The resinous woods necessary for use in this plant are accessible in large quantities at cheap rates, not only from the many mills in Vancouver and near vicinity, but also from the standing timber that is not suitable for lumber, and can readily be procured. The plant has recently been increased to treat forty cords of wood per day.

Illumination and the Eyes.

In an article on the formation of "The Illuminating Engineering Society" in Great Britain the *Lancet* gives some instructive criticism on our present methods of illumination. "The aim of the engineer," says the *Lançet,* "has been to obtain the maximum efficiency — that is, maximum illumination at minimum cost. The distribution of the sources of light has been controlled by the architect, who is perhaps unduly swayed by convenience and artistic considerations. Both he and the engineer have paid relatively little attention to the physiological problems involved. Always important, these have become still more so with the advance of the art of illumination. The introduction of new inventions, such as the metallic-filament lamp, has led to the use of light extremely rich in ultra-violet rays. It is well known that these rays are deleterious to vision, and it has become imperative that some supervision shall be exercised over the artificial illuminants in general use. The object of the Illuminating Engineering Society is to bring together all the branches of the illuminating engineering profession, as well as architects, ophthalmologists, and physiologists, so that the problems may be fully discussed without any commercial bias and with the aim of the highest good for the greatest number only in mind. If the society maintains this lofty ideal it will deserve well of the medical profession and should receive its warm support."

Lighting Central Park, New York.

Central Park will be lighted before long by 1,400 electric lamps in place of the 600 old-style gasoline ones that have flickered through many a night in the quiet recesses of the park. The new lamps will have artistic merit, too, and they will also light up some dangerous crossings and viaducts.

Four models for the new lamp-posts have been submitted, but the Municipal Art Commission will have one designed at its own expense. The four submitted were used on the Mall in the park one night last week.

To install the new lights will call for an expenditure of about $32,000. The leakage from the old lamps in the park has ruined the grass for two or three feet around each lamp-post. Moreover, short cuts have been taken by the lamplighters in their anxiety to finish in a hurry, making roads through flower beds and creating footpaths on many of the green hillsides.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on June 29 for miscellaneous accessories for fire-alarm systems, for delivery at Washington, D. C.; and for 700 water-tight boxes, miscellaneous red sheet fiber, 900 fuses, twenty-four electric soldering irons, and miscellaneous wire and cable, to be delivered at New York, N. Y.

Bids will be opened on July 13 for miscellaneous annunciators, controllers, carbons, heaters, lamps, irons, voltmeters, wire and other electrical supplies; for 1,250 dry-battery cells and fifty water-tight bells; and for seventy-five yards linotape, miscellaneous linen tape, thirty switchboard instruments, miscellaneous micanite plate and red fiber, all for delivery at Mare Island, Cal. Bids will also be received on July 13 for remodeling a 110-ton electric overhead traveling crane, for delivery at Washington, D. C.

Bids will be opened on July 20 for two electric freight elevators for delivery at Mare Island, Cal.

General Electric Outing.

The fourth annual outing of the New York city staff of the General Electric Company was held at New Dorp, Staten Island, N. Y., on Saturday, June 19. One hundred and sixty-six were in attendance, and G. W. Seager was chairman of the committee on arrangements.

The sports consisted of baseball and athletic games, for which prizes were given. There were quoit pitching, a 100-yard dash, mile run, potato race, etc. Several competed in the mile run, which was won by M. J. Powers. The main event of the day, however, was a comedy baseball match between the young men and the "old boys." It consisted of three innings, and was won by the "old boys" with a score of seventeen to nine. S. W. Trawick was captain of the "elders," and M. F. Reardon was captain of the young men. Another important game was between the younger men, in which the single gentlemen and the married gentlemen fought on opposite sides. The single men won. The score is not given, because the scorekeeper became exhausted.

In addition to those named above, among others present were T. Beran, F. C. Bates, C. R. Dean, J. J. Mahony, H. H. Barnes, A. D. Babson, L. B. Judson, P. D. Wagoner, W. S. Brayton, D. A. Brown and F. C. Ross. F. C. Bates carried off the honors in baseball.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

OAK PARK ELEVATED.

The report of the Oak Park Elevated Railroad Company for the year ended June 30, 1908, compares as follows:

	1908.	1907.	1906.
June gross	$870,124	$892,569	$886,783
Operating expenses	537,259	527,180	505,538
June net	$332,865	$365,389	$381,245

CHICAGO TRACTIONS.

The original valuation of the Chicago traction lines, under their new ordinances, rehabilitation certificates subsequently reported to the city authorities under the partnership agreement, and the capital account in each case as of May 1, 1909, are shown in the following table:

	Valuation.	Rehabilitation.	Total Capital.
City railway	$21,000,000	$15,753,901	$36,753,901
Chicago Railways	30,779,875	11,565,205	42,344,980
Calumet & South Chicago	5,000,000	335,700	5,335,700

The City Railways' first mortgage bonds amount to $22,000,000, and the Chicago Railways Company reports total bonds and temporary receipts of $14,000,000, but will place $5,000,000 or $6,000,000 additional rehabilitation mortgage bonds soon.

HUDSON TUNNEL RECEIPTS.

The New York Public Service Commission made public yesterday the financial statements of the Hudson & Manhattan Railroad from the time the first traffic was carried under the river on February 26, 1908, to June 30 of last year. During this period only the first link of river tube was open, consequently the operating revenue was only $222,415, as against operating expenses of $229,680.

There was income from the Hudson Terminal Buildings and other real estate amounting to $66,361, and when miscellaneous charges had been adjusted an annual surplus of $47,458 remained.

The balance sheet showed total assets of $102,201,270, in which the cost of road and equipment was stated at $101,514,348. The company showed a corporate surplus of $47,458.

WESTERN UNION TELEGRAPH COMPANY.

Accompanying the report of the Western Union Telegraph Company for the quarter ended June 30 last, which shows an expansion of the company's business, is a statement from President R. C. Clowry, whose remarks follow: "The net earnings for the present quarter are $1,266,937, or 1.27 per cent, on the capital stock. The fiscal year of the company ends June 30, and the estimate of net earnings for the year are $5,450,000, or at the rate of five-and-one-half per cent per annum on the capital. These figures do not include expenditures for construction or betterment, which for the past one-and-one-half years have been paid for out of the net earnings. Our disbursements on this account last year amounted to $1,218,521, and for the current year are estimated at $800,000. Treating one-quarter of this, or $200,000, as applicable to the present quarter, the net earnings for the quarter, after providing for construction, are $1,066,937, or 1.07 per cent."

The preliminary estimated report of earnings for the quarter compares with actual figures for the same period a year ago as follows:

	1909.	Changes.
Net revenue	$1,700,000	*$120,340
Bond interest	433,062	Unchanged
Balance	$1,266,938	*$120,340
Dividends	747,400	*249,854
Surplus	$ 519,538	†$129,514

*Increase. †Decrease.

Following are the approximate figures for the year ended June 30, 1909, as compared with actual figures in the previous twelve months:

	1909.	Changes.
Net revenue	$ 7,179,912	*$3,776,915
Bond interest	1,732,249	Unchanged
Balance	$ 5,447,663	*$3,776,915
Dividends	2,739,443	*1,024,872
Surplus	$ 2,708,220	*$2,752,044
Previous surplus	14,393,857	†2,490,924
Total surplus	$17,102,077	*$ 261,120
Appr. for stock div		*2,447,100
Profit and loss surplus	$17,102,077	*$2,708,220

*Increase. †Decrease.

HAVANA ELECTRIC RAILWAY COMPANY.

A plan for retiring the $5,000,000 of six per cent preferred stock of the Havana Electric Railway Company and replacing it by an issue of bonds was considered at the monthly meeting of the directors of the company. After the meeting it was stated that the details of the plan had not been worked out as yet, and that no definite action in the matter was likely to be taken for some time. General Manager Frank Steinhart, formerly United States Consul General in Cuba, who attended the meeting, said that the company's affairs showed a steady improvement and that conditions in Cuba were generally satisfactory at present.

NORTHWESTERN ELEVATED.

Chicago Northwestern Elevated financing, which has been temporarily held in abeyance by the elevated merger, will now be concluded. The present four per cent bond issue will probably be refunded by a four-and-one-half per cent issue, for which bids have been received from two eastern banking houses. It is expected that dividends on the preferred stock at the rate of four per cent will be commenced shortly.

NORTHERN LIGHT AND POWER COMPANY.

The Northern Light and Power Company, which acquires the Dawson City Electric Light and takes over the Yukon Telephone Syndicate, has issued in London $2,000,000 five per cent mortgage bonds carrying twenty-five per cent bonus in shares.

LONDON UNDERGROUND.

The Underground Electric Railways of London report gross earnings for the week and twenty weeks ended May 29, 1909, compared as follows:

Company.	1909.	1908.
Bakerloo	£ 3,320	£ 2,940
Piccadilly	5,790	5,500
Hampstead	4,010	3,345
District	10,310	9,302
Tramways	6,895	7,942
Total	£ 30,325	£ 29,029
Total twenty weeks	592,642	554,145

KEYSTONE TELEPHONE COMPANY.

The Keystone Telephone Company, of Philadephia, reports gross earnings for May of $91,727, an increase of $4,140; net earnings of $46,672, an increase of $1,953, and surplus after charges of $12,661, an increase of $2,639. For eleven months the company earned gross $980,411, an increase of $17,040, and net $494,055, an increase of $29,408. The surplus, after charges, was $116,232, an increase of $29,678. These figures compare with the corresponding period a year ago.

WESTERN ELECTRIC.

Preliminary returns for May show that the business of the Western Electric Company is running at the rate of between $46,000,000 and $48,000,000 per annum. This would make the gross returns for the first half of the company's fiscal year ended with May, show business of close to $23,000,000, or an average of nearly $4,000,000 a month.

April sales were fifty per cent larger than in April, 1908, and the sales in May were seventy per cent greater than the corresponding month in the previous year. Each month in the current calendar year has shown gains over the preceding month, and each month's returns have been greater than the same months in 1908, so that with a continuance of the present rate of monthly increase will enable the company to show gross returns for the year of $50,000,000 or better.

The report that the General Electric

Company had completed arrangements to take over the heavy-machinery manufacturing branch of the Western Electric at Hawthorne was declared by an officer of the company to be without foundation.

During the last month the Western Electric, on the basis of business in sight, has taken advantage of the low price of copper to purchase more of the metal than it has bought for a long time. The company's consumption, however, is still below the ration to be expected from the ratio of operations. Its stocks of metal on hand are still only nominal.

UNITED TRACTION (ALBANY-TROY).

The report of the United Traction Company (Albany-Troy, N. Y.) for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating rev...	$454,260	$453,702
Total railway operating exp...	295,210	323,799
Net railway operating rev...	$159,049	$129,903
Taxes accrued	33,000	24,631
Operating income	$126,049	$105,272
Other income	44,282	39,990
Gross income	$170,331	$145,262
Total deduc. from gross income.	83,521	74,999
Net corporate income	$ 86,809	$ 70,262

AMERICAN TELEPHONE EARNINGS.

The Associated Bell Operating Companies, not including long-distance lines of the American Telephone and Telegraph Company, report for April and four months as follows:

April:	1909.	1908.
Gross earnings	$11,093,600	$10,282,000
Expenses	7,972,500	7,293,500
Net earnings	$ 3,121,100	$ 2,988,500
Interest	603,700	641,800
Balance for dividends	$ 2,517,400	$ 2,346,700
Jan. 1 to April 30:		
Gross earnings	43,260,700	40,560,400
Expenses	31,573,200	29,371,400
Net earnings	$11,687,500	$11,189,000
Interest	2,402,200	2,615,400
Balance for dividends	$ 9,285,300	$ 8,573,600

These figures for 1908 include a proportionate part of the extraordinary provision for depreciation for the year made in December, 1908. Equivalent or greater provision is being made for each month of 1909.

AUBURN & SYRACUSE ELECTRIC.

The report of the Auburn & Syracuse Electric Railroad Company for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$81,948	$70,741
Total railway operating expenses.	59,993	50,847
Net railway operating revenue.	$21,955	$19,894
Taxes accrued	4,200	4,200
Operating income	$17,755	$15,694
Total deduc. from gross income..	21,425	18,821
Net corporate deficit	$ 3,669	$ 3,127

MEXICAN TELEPHONE COMPANY'S YEAR.

The Mexican Telephone and Telegraph Company reports gross earnings for the year ended February 28 last (Mexican currency) of $385,767, a decrease of $2,265, and net of $181,437, an increase of $2,771. The surplus was $20,417, a decrease of $65,259.

MONTREAL LIGHT, HEAT AND POWER.

The Montreal Light, Heat and Power Company has issued its full pamphlet report for the year ended April 30, 1909. The income account compares as follows:

	1909.	1908.
Gross	$4,079,769	$3,792,318
Expenses	1,844,653	1,651,656
Net	$2,235,116	$2,140,562
Interest	489,268	493,095
Surplus	$1,745,848	$1,647,467
Dividends	1,020,000	1,020,000
Year surplus	$ 725,848	$ 627,467
*Deductions	418,380	.....
Surplus	$ 307,468	$ 627,467

*Deductions for depreciation and insurance funds.

FAIRMONT & CLARKSBURG TRACTION.

The report of the Fairmont & Clarksburg (W. Va.) Traction Company for April and four months ended April 30 compares as follows:

Month of April:	1909.	1908.
Total earnings from operating.	$31,296	$29,272
Operating expenses	12,643	10,850
Net earnings from operating.	$18,653	$18,422
Income from sources	3,598	1,940
Income all sources	$22,251	$20,362
Less taxes and insurance	1,892	1,069
Net earnings	$20,358	$19,293
Four months:		
Total earnings from operating.	114,919	107,231
Operating expenses	50,577	46,946
Net earnings operating	$64,341	$60,284
Income other sources	13,128	9,962
Income all sources	$77,470	$70,246
Less taxes and insurance	7,587	4,305
Net earnings	$69,882	$65,941

BINGHAMTON RAILWAY COMPANY.

The Binghamton Railway Company has issued its report for year ended May 31, 1909, which compares as follows:

	1909.	1908.
Gross earnings	$331,700	$301,816
Operating expenses	190,348	179,203
Net earnings	$141,352	$122,613
Interest and taxes	106,815	99,216
Surplus	$ 34,536	$ 23,396

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of May and five months ended May 31 compares as follows:

	1909.	1908.
May gross	$ 975,544	$ 920,765
Expenses	597,240	591,543
May net	$ 378,304	$ 329,222
Charges	232,792	232,278
Surplus	$ 145,512	$ 96,944
Five months' gross	4,427,551	4,248,216
Expenses	2,830,582	2,795,250
Five months' net	$1,596,969	$1,452,966
Charges	1,172,308	1,154,714
Five months' surplus	$ 424,661	$ 298,252

FORT WAYNE & WABASH VALLEY.

The Fort Wayne & Wabash Valley Traction Company reports for April and four months, as follows:

	1909.	1908.
Gross earnings	$106,250	$ 99,740
Operating expenses	65,973	59,381
Net earnings	$ 40,276	$ 40,359
January 1 to April 30:		
Gross earnings	$420,971	$397,975
Operating expenses	253,267	231,814
Net earnings	$167,713	$166,161

CHICAGO RAILWAYS COMPANY.

N. W. Harris & Company and the National City Bank, of New York, have purchased from the company $5,000,000 Chicago Railways Company first mortgage five per cent bonds, the proceeds of which will be used for rehabilitation and extensions.

The Chicago Railways' order with Pullman for 350 more pay-as-you-enter cars aggregates $1,600,000.

NEW INTERBOROUGH BOND ISSUE.

The Interborough Rapid Transit Company has applied to the New York Public Service Commission for permission to issue $10,000,000 in bonds under the $55,000,000 mortgage approved by the Commission last year to retire an issue of three-year gold notes, dated March 1, 1907, and maturing March 1, 1910. The bonds are to bear interest at five per cent, and are to be sold or exchanged for the three-year notes at not less than par. The petition is signed by August Belmont, chairman of the board of directors of the Interborough company, and Richard Reid Rogers, counsel for the company.

The petition shows that on April 24, 1908, the Commission authorized the execution by the company of a mortgage upon its property to the amount of $55,000,000, and on the same date authorized the immediate issue of the $30,000,000 in bonds to secure three-year six per cent notes, dated May 1, 1908, in the amount of $25,000,000. It is further alleged that on March 1, 1907, the company issued $10,000,000 of three-year five per cent gold notes, with a provision that the notes might be retired upon any interest date at 101 and accrued interest. The mortgage authorized the reservation of bonds to retire the three-year five per cent gold notes, and that the company might at any time tender to the trustee any of the gold notes in exchange for bonds reserved, and that the trustee should receive and cancel the notes and deliver to the company an equal amount of reserved bonds.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

ELECTRICALLY DRIVEN PRINTING PRESSES OF THE LONDON TIMES.

The London *Times* has recently installed a large octuple press, electrically driven and controlled on the Crompton-Kohler System, the first of four machines of the same pattern which are to be installed. Each will be a double machine, capable of printing 60,000 copies of *The Times* per hour, and if required, the two units of each press can be worked separately. The system of control is the well-known "Kohler" system, developed by Kohler Bros., of Chicago, U. S. A., and 56 Ludgate Hill, London, E. C., and the motors are by Crompton & Company, Ltd., London and Chelmsford. The equipment consists of two sixty-horsepower and two ten-horsepower motors for each press, and the standard "Kohler" four-motor controller with sixteen push-button control stations at various points about the press, each station comprising a small iron box with five push-buttons. The main sixty-horsepower motor is coupled direct to an extension of the press shaft. A worm wheel runs free on the main shaft, but carries a ratchet wheel, which engages with pawls pivoted on a disk keyed to the press shaft. The rotation of the worm by the small ten-horsepower motor starts the worm wheel and engages the ratchet with the pawls, and causes the machine to be driven at a slow speed. When the small motor has attained full speed, the main motor is automatically put in circuit, the pawls leave the ratchet free, and the small motor and worm wheel are brought to rest. The small motor is used for operating at slow speed when dressing the press and leading in the paper web. The main motor takes up the load and overruns the small motor when operating at printing speed. The whole of the manipulation of the controller is carried out from any one station, permitting the operator to start, stop, run up the speed, or slow down, and also to lock the controller at any given speed or to lock it at the stop position. Thus absolute control of the movements of the press is placed in the hands of the operator from the point where he is working. This printing press can be used either as a whole to produce papers of twenty-four to thirty-two pages, or as two separate presses producing papers of four to sixteen pages. Therefore two separate motors and control outfits are provided, and these can be run either as two sets or as one set; in the latter case the motors and push-buttons are automatically paralleled when the mechanical clutch connecting the two units is placed in gear. The chief features of the "Kohler" system of control are as follows: For putting on blankets or plates, the cylinders can be brought to any desired position, and a movement of only one-eighth of an inch can be made. Again, the speed of the plate cylinders can be varied from ten revolutions per minute through several intermediate speeds to the maximum speed. While a press is being made up, and a pressman is working on any part of it, he can make it impossible for anyone to start the press by pressing the "safe" button. To start the machine he must press the "on" button. The "safe" button only prevents any alterations being made to the existing conditions; thus, pushing this button when running at a certain speed prevents increase or decrease of speed. To accelerate, the "on" button is pressed, and to slow down the "off" button is pressed. Pushing the "stop" button stops the machine in a few seconds. Whenever the machine is stopped the controller automatically returns to the starting point. The time required to bring the press from standstill to maximum speed can be adjusted, but is usually twenty seconds. The time required to stop the press is only the few seconds necessary to prevent stripping the gears. The press is first started up on the small ten-horsepower motor through the worm gearing by pressing the "on" button, which releases a plunger. The plunger descends slowly, cutting out the starting resistance of the small motor; its descent can be arrested by pressing the "safe" button. If allowed to descend further, the small motor reaches its maximum speed, and the large sixty-horsepower motor takes up the load. The contacts behind the plunger belong to the starting resistance of the small motor, and the side contacts belong to that of the larger motor. On pressing the "off" button, the plunger rises slowly, reducing the speed and eventually, unless arrested, transferring the load on to the smaller motor in case it is desired to run at a slow speed or to move the rollers to any particular position. The starting resistances for the large motor would have to be abnormally heavy if it was necessary to run this at the slow speeds; and, moreover, the small and certain movements rendered possible by the use of the small worm-geared motor would be impossible to attain with the large motor only. Both the main and the small motors are compound-wound, and the former are provided with interpoles. A variation of speed between 550 revolutions per minute and 700 revolutions per minute is obtained on the main motor by shunt regulation, the rest of the regulation being by series resistances. The main switches are controlled by the "stop" button and the overload and no-voltage cut-outs. When the main switches open, they short-circuit the motors at the same time, which brings the machines to rest in one or two seconds. *The Times* plant was originally steam driven, but two years ago, an electrically driven rotary was installed, and, very soon, the whole of the plant will be electrically driven. Power is taken from the Charing Cross & City Electricity Supply Company, with a stand-by from the mains of the City of London Company. The necessary change-over switchboard and a large main distributing switchboard have been installed, the latter in a gallery in the machine room. The main switchboard has ten panels; of these, two are change-over panels for the lighting and power, respectively, three are press panels, two are motor panels, and two are lighting panels; the remaining panel contains the recording instruments. The over-all length of the board is approximately twenty-six feet, and the height seven feet.—*Abstracted from Electrical Engineering (London), June 3.*

ELECTROMAGNETIC EXTRACTORS FOR EYE TROUBLES.

A special type of extractor for dealing with particles of iron, steel, etc., imbedded in the eye, has been devised by John

Hunter & Company, Liverpool, Eng., and has been largely adopted in the hospitals and by well-known surgeons. There are two varieties. The one for operation on a standing or sitting person has a heavy cast-iron stand carried on gunmetal wheels so that the device may be easily moved about the room. The magnet consists of a core of best Swedish soft iron, three feet long and six inches in diameter, which is energized by two coils wound with about 200 pounds of double cotton-covered insulated wire. It is turned off blunt at the ends and screwed so that pointers of different shapes can be fitted as desired. The magnet is mounted on a cradle which rides on ball bearings so as to have a circular horizontal motion. The magnet coils are connected in series, and a switchboard, which may be mounted on the stand or on the wall of the room, is provided with a regulating resistance, besides the necessary main switches and fuses, in order to vary the strength of the current in the coils, and therefore the degree of magnetization of the core. With a maximum current of eight amperes a pull of thirty pounds per square inch is obtained at a distance of one inch from the end of the magnet. The height of the magnet from the ground is about four feet six inches. The magnet for use on patients in a reclining position is mounted on trunnion bearings and is tilted by a quadrant gear turned by a hand-operated worm fitted on the side of the stand.—*Abstracted from The Electrician (London), June 4.*

ELECTRICAL METHODS OF VACUUM MEASUREMENT.

The operation of electrical vacuum meters is based on the fact that gas conducts heat more poorly with decreasing pressure. It is known that the sensitiveness of a thermo element increases greatly in a vacuum, and this phenomenon has been utilized by Voege in his vacuum meter. In a glass bulb G (Fig. 1) he encloses hermetically a thin wire AB in such a way that an electric current may be sent through it. Crossing this wire is another conductor EE', consisting half of iron Fe and half of constantin C, the two parts being soldered in the center at P. The two wires AB and EE' are in contact at P. The latter wire acts as a thermo element, and if an electric current is sent through AB, a thermo current will flow through a circuit connected to E and E'. The temperature reached by AB depends, of course, on the intensity of the current flowing through the wire and also on the cooling to which it is subjected by the heat conductivity of the air in the vessel G. This conductivity will diminish with increasing rarefaction, and provided that a constant current is flowing through AB the temperature of this wire will rise and also the electromotive-force of the thermo current. If, therefore, the thermo element EE' is connected to a sensitive galvanometer the latter will indicate a stronger current with increasing rarefaction, which may serve as a measure of the degree of the vacuum. The vessel G is provided with a tube L for connecting it to the space, the vacuum of which is to be measured. The galvanometer may be graduated to indicate directly the vacuum in millimetres mercury pressure. It should be remarked, however, that on account of the different heat conductivity of various gases and vapors, the indications of the electrical measuring instrument will have a different value for each gas or vapor, even under otherwise identical conditions. The electrical vacuum meter designed by

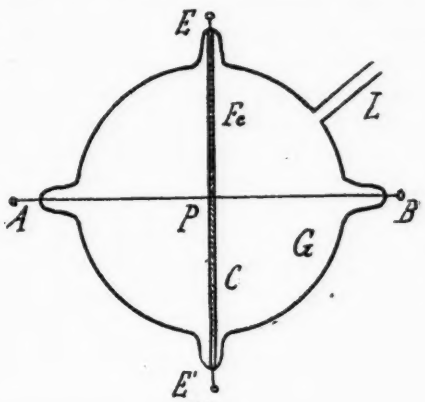


FIG. 1.

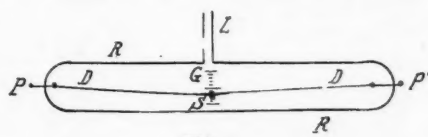


FIG. 2.

G. Berndt distinguishes itself by its simplicity and is undoubtedly most to be recommended for practical purposes, particularly because it requires no instrument for measuring resistances or current intensity. A wire D is stretched in a bulb R (Fig. 2), provided with a tube L for connecting it to the vessel, the vacuum of which is to be measured. A small weight S is attached to the center of wire D. If a current of constant pressure is sent through this wire it will be heated to a certain temperature dependent on the current intensity and on the amount of heat conducted away by the gas in the bulb R. The more the gas is rarefied the more will its heat conductivity decrease and the temperature of the wire will rise. This will cause the wire to expand and show a certain sag, which will always be regular on account of the weight S. If the bulb R is provided with a scale at the location of the weight, the extent of the sag may be observed on the same and will serve as a measure of the vacuum.—*Translated and abstracted from Elektrotechnische Anzeiger (Berlin), May 30.*

POWER FOR MINING PURPOSES.

The principal sources of power for the conduct of mining operations are steam, compressed air and electricity, although for certain operations the internal-combustion engine must be considered as a formidable competitor which cannot be ignored. Steam power still maintains a prominent position for the operation of hoisting and pumping machinery, for surface tramming, and for general power purposes. For underground use, however, it is decidedly inferior to compressed air and electricity, chiefly owing to the disagreeable effects of heat and moisture on the mine atmosphere. Although there is some rivalry between compressed air and electric power for operating machinery of mines, each, at present, occupies a field pretty much of its own, which may, however, be altered somewhat by future developments. Compressed-air drills have given better results in some cases than direct-operated electric drills, but by means of a compromise system in which an electrically driven air compressor of small size compresses air on the spot for operating a compressed-air drill, the advantages of both compressed air and electricity are utilized. For underground pumping and hoisting compressed air finds considerable application. The exhaust into the mine atmosphere of all air-driven motors is a decided benefit to ventilation. Owing to its flexibility and wide range of applicability the field for electricity in mining is steadily increasing, and electric pumps, hoists and locomotives are used extensively wherever electric power is available. Its greatest usefulness is perhaps felt where many mines can be supplied with power from some central power plant. Centralization in power generation means economy, and power can thus be transmitted to a large number of mines as electricity, and sold for lower price than it could be generated by individual plants at the separate properties.—*Abstracted from The Mining World, June 12.*

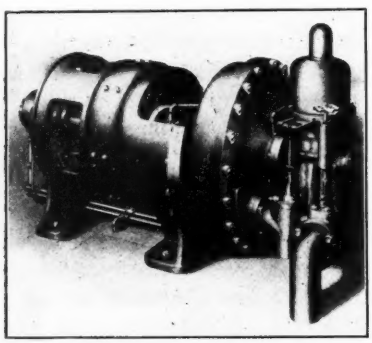
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The New Westinghouse Train-Lighting Turbine-Generator Set.

The new Westinghouse "train-lighting" turbine-generator set meets the exacting requirements of a small steam-driven generating outfit for train-lighting excitation, or other small-power, direct-current service, securing to a marked degree the advantages of compactness and minimum weight which result from the improvements in design of both its electrical and steam elements. The generator output is twenty-five kilowatts at 125 volts, and is designed to be run at 3,600 revolutions per minute. The turbine element is of the impulse class, but of novel construction. A single wheel is employed, involving a re-entrant path for the steam, which is expanded practically to exhaust pressure in the nozzles.

The generator is compound-wound, insuring close voltage regulation, while its four-pole field structure with auxiliary



WESTINGHOUSE TRAIN-LIGHTING TURBINE-GENERATOR SET.

commutating poles, makes possible diminished weight and length of commutator, and thus, shortened over-all dimensions, accomplished in no other design. The compact structural connection between the turbine case and generator frame also contributes to shortening the over-all shaft length, adapting the outfit admirably to installing in the restricted space of the baggage car, where, in train-lighting service, it is intended to be placed. On account of the possible oscillation and vibration of the car, oil rings are not relied upon for lubrication of the two bearings, an oil pump, attached to the turbine, being provided to insure circulation of oil in ample quantity while the outfit is in operation. Provision is also made for accurately balancing the rotating part, avoiding any possible vibration that might occur.

A well-designed fly-ball governor, geared directly to the turbine, controls a nickel-bronze balanced puppet valve. The governor mechanism is unique in design, insuring excellent regulation, stability and certainty of operation. With the turbine is furnished a combined automatic and hand throttle valve, the automatic feature of which is operated by a weight held by a spring against centrifugal force, and entirely independent of the main governor. The apparatus is exceedingly simple, and hence certain in its operation. The device may be regulated to come in at any predetermined speed.

The new Westinghouse train-lighting turbo-generator set, embodying superior advantages of lightness, compactness and efficiency, as above noted, was exhibited, for the first time, in the Westinghouse space at the conventions of the Master Mechanics' and Master Car Builders' associations held at Atlantic City, June 16 to 23.

A Successful Enterprise.

Under the title "A Successful Enterprise" the Robbins & Myers Company, Springfield, Ohio, has published a handsomely illustrated treatise, devoted to a description of its growth and development and the establishment of its new works and electrical plant. The Robbins & Myers Company was organized about twenty years ago for the making of gray iron castings, and after a number of years of very gratifying success in that business found itself in possession of such a plant and facilities as would warrant its undertaking a regular manufacturing enterprise in a modest way. In 1897 the company commenced the manufacture of direct-current motor-driven ceiling fans, taking its place among the pioneers in a practically undeveloped industry. Recognizing the severe operating requirements of a motor for an electric fan the company set about the producing of a practically indestructible motor.

The company soon devoted its attention to the producing of small power motors and rapidly equipped new quarters for the production of this line of apparatus, developing direct-current motors of new types and capacities up to fifteen horsepower.

In 1907, so successful had been the company's operations in this direction that plans were laid for the building of an entirely new machine shop and motor department. The work was undertaken at once and the factory ready for occupancy early in the winter of 1908. In the new buildings every attention has been given to providing comfortable working conditions for the employes, the entire plant is heated by the blower system, the company has its own waterworks system, taking its water from an underground spring, and is amply equipped for fire protection.

The power plant consists of two large, horizontal gas engines, belted directly to generators, current being taken to large switchboards located in the main testing-room, and distributed on the three-wire system to about 150 motors driving machinery in various parts of the factory.

The equipment winding room is worthy of special mention, as the use of special machinery has been made wherever this could be done to advantage. The company has designed and built for its own use a complete equipment of special winding machines, able to handle a wide range of armatures and field coils, which appears to be a great improvement on the work done by hand, and also increases the possible output.

The main offices of the company are located at Springfield, Ohio, forming an integral part of the manufacturing plant. The appointments are unique in their modern completeness.

In addition to the descriptive matter concerning the growth and development of the company and its facilities, there are illustrated a number of typical applications of the company's motors, together with some brief descriptive matter concerning these various lines.

Battery Charging in Automobile Garages With Mercury-Arc Rectifiers.

In many electric-automobile garages having a capacity for charging two or more batteries at one time, the charging is done directly from direct-current feed-

ers or through a motor-generator set from alternating-current feeders. The general connections are similar to those shown in Fig. 1, either with or without the motor-generator. There are a small number of garages using single-circuit rectifier outfits, one for each battery to be charged, but while this method is very satisfactory and highly efficient, the cost of the original installation is rather more than most garages care to invest for this purpose.

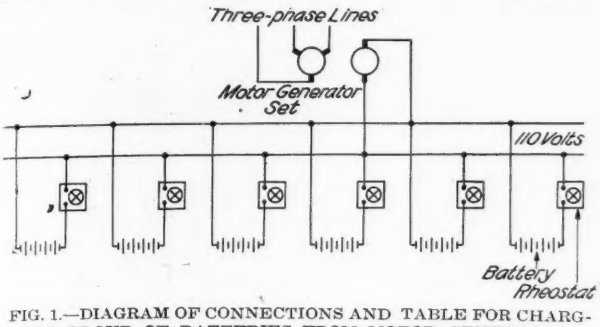


FIG. 1.—DIAGRAM OF CONNECTIONS AND TABLE FOR CHARGING GROUP OF BATTERIES FROM MOTOR GENERATOR.

	Circuit—						
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	Ttls.
No. cells	44	40	30	24	16	12	166
Volts, av.	101	92	69	55	37	28	...
Amperes, av.	20	20	20	20	20	20	120
Watts used	2,020	1,840	1,380	1,100	740	560	7,640
Watts lost	180	360	820	1,100	1,460	1,640	5,560
Watts, total	2,200	2,200	2,200	2,200	2,200	2,200	13,200
Per cent efficiency	92	84	63	50	34	25	58

A large number of charging garages are now using the public-garage type of rectifier, which is described later in this article.

Referring again to Fig. 1, let it be assumed that six batteries are to be charged from the 110-volt circuit, and that the number of cells in the various batteries is as follows: No. 1, forty-four; No. 2, forty; No. 3, thirty; No. 4, twenty-four; No. 5, sixteen; No. 6, twelve. The tabulation in Fig. 1 shows the actual watts delivered to the battery, the watts lost in the rheostats and the efficiency of each circuit, neglecting the loss in the motor-generator set. It will be seen from the last column that the efficiency of the complete system, exclusive of the motor-generator set, will be about fifty-eight per cent; with the motor-generator set having an approximate efficiency of seventy-five per cent, the efficiency of the system will average about forty-four per cent.

The public-garage type of mercury-arc rectifier is shown in Fig. 2. This outfit is designed for use on a 220-volt, sixty-cycle, alternating-current circuit and consists of a two-panel dull-black slate switchboard, with necessary regulating compensator, reactance, equalizing rheostats, rectifier tubes and necessary switches, all suitably mounted, with a view to obtaining the most compact and convenient equipment possible. The left-hand panel of the switchboard is known as the rectifier-controlling panel, and on it is mounted the apparatus particularly essential to the starting of the rectifier tube and regulation of the rectified current. The right-hand or charging-circuit panel is equipped with six triple-pole, double-throw switches, which lead to the various charging circuits; two sixty-ampere ammeters and a six-point voltmeter switch for adjusting one of the voltmeters on the left-hand panel for reading the voltages of the various batteries being charged.

The general scheme of connections of the charging circuits on the garage panel is outlined in Fig. 3. The rectifier when charging a group of batteries similar to that shown in Fig. 1, would supply an average of about 193 volts on the charging circuit. It will be noted from Fig. 3

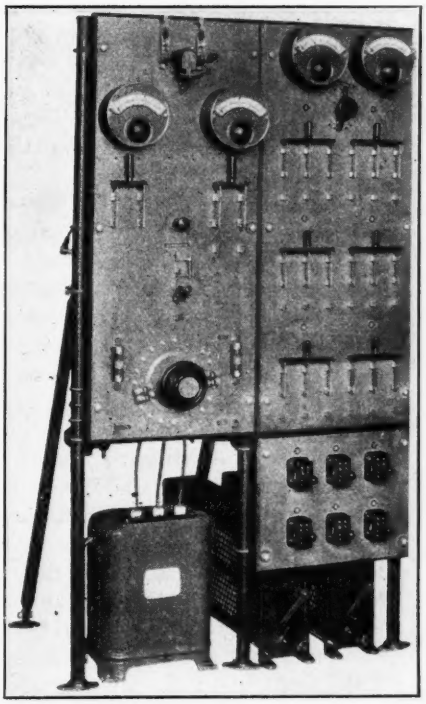


FIG. 2.—PUBLIC GARAGE TYPE OF RECTIFIER PANEL.

that the six batteries are arranged in two circuits of three batteries each, the batteries being equally divided between the two circuits. The tabulation just below the diagram gives the losses and efficiencies when charging with these connections. It will be noted from this table that the average efficiency of the charging circuits alone, neglecting the very small losses in wiring, is ninety-nine per cent. As the efficiency of the rectifier when delivering 193 volts is about eighty-four per cent, the total combined efficiency of the complete charging equipment would be about eighty-two per cent.

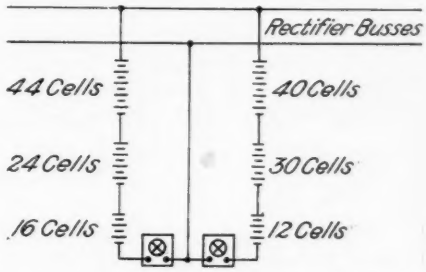


FIG. 3.—TWO CIRCUITS OF THREE BATTERIES EACH.

	Circuit—		
	No. 1.	No. 2.	Ttls.
No. cells	84	82	166
Volts, av.	193	189	...
Amperes, av.	20	20	40
Watts used	3,860	3,780	7,640
Watts lost	0	80	80
Watts, total	3,860	3,860	7,720
Per cent efficiency	100	98	99

Referring to the table in Fig. 1, it will be seen that the total watts used in the charging circuits is 13,200. At seventy-five per cent efficiency, this would mean an input to the motor-generator set of about 17.6 kilowatts. The input to the rectifier under the conditions shown in Fig. 3 would be about 9.2 kilowatts, representing a saving of 8.4 kilowatts for each hour of operation under similar conditions. Of course, a small part of this saving would have to be used for buying renewal tubes for the rectifier, but even considering the slight additional expense, the saving in power could figure out at least twenty or twenty-five per cent.

While some garage operators might consider the combination of cells given in the foregoing example as an unfavorable case, it should be borne in mind that batteries of the various number of cells mentioned are furnished by representative electric-vehicle manufacturers for use in their vehicles. Nor is it possible for a garage to control the conditions and make them most favorable to the charging plant; for example, garages are frequently called upon to charge a single battery with a large number of cells, say, a forty-cell battery; and a large number of batteries with a smaller number of cells, for instance, five twenty-four-cell batteries. When charging such a group of batteries from a 110-volt, direct-current circuit, the efficiency would be about forty-four per cent. When charging the same batteries

with a rectifier the efficiency would be about seventy-five per cent.

The accompanying tabulation of efficiencies when charging various sizes of batteries is given herewith. For the sake of comparison, the charging rate on all batteries is taken as twenty amperes, and the average volts per cell as 2.3. While some batteries are designed for a heavier charging rate, the average battery can be efficiently and economically charged at this rate, although the time of charging may be somewhat longer.

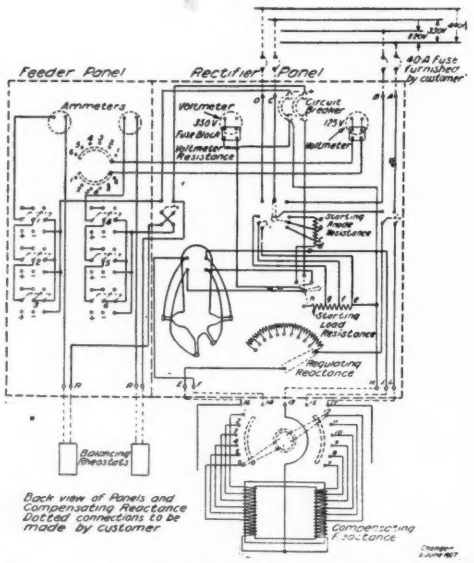


FIG. 4.—COMPLETE DIAGRAM OF CONNECTIONS, RECTIFIER GARAGE SET.

There are, of course, almost innumerable combinations of batteries possible, but the above will give the general basis for comparison between the various methods of charging.

It will be noted from Fig. 4, which is a complete diagram of connections of the rectifier garage set, that when a battery is connected to the terminal of each of the triple-pole switches marked + and — and the switches thrown in the upper position, the batteries are connected in two-series groups similar to Fig. 3. If all the twelve-cell batteries are to be charged at one time, they may be charged in series by simply reversing the position of a double-pole, double-throw switch on the left-hand panel. For practically all charging, however, the circuits will be connected in series multiple, as shown in Fig. 3.

In each of the two-series charging circuits are connected a sixty-ampere ammeter and a rheostat for equalizing the current between the two circuits. In order to use as little of the resistance as possible the number of cells of battery should be arranged to be as nearly equal as practicable. When it is desired to cut out a battery for any reason, the switch to which this battery is connected should be opened, a sufficient amount of the charging rheostat cut in and the switch thrown into the upper position. This cuts out the battery, but the series circuit is not broken and the charging of the remaining batteries will be continued

A sub-base, shown below the right-hand section in Fig. 2, is sometimes furnished. This sub-base is equipped with six non-reversible plug receptacles and six charging plugs. To these plugs should be attached six charging cables, leading to various points in the garage. The use of this sub-base permits of readily changing the various batteries under charge from one circuit to the other, in order to make the most efficient combination without moving the vehicles from place to place in the garage.

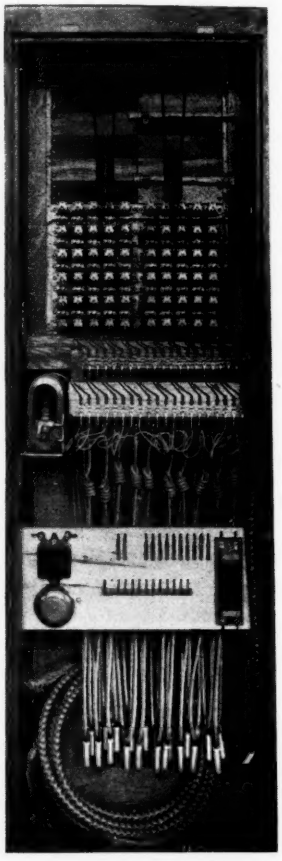
With this type of rectifier it is possible to charge at one time a total of 180 cells of lead-plate battery at twenty amperes each.

About thirty of these garage panels are now in actual service, giving excellent results and proving that the above efficiencies outlined are not merely theoretical.

A New Type of Kellogg Switchboard.

The Kellogg Switchboard and Supply Company, Chicago, Ill., has placed on the market a new No. 20 drop-type combined self-restoring drop and jack, which has all of the advantages of the old No. 3 type, with the additional features of a platinum night-alarm contact, protected by the shield below the shutter, and drop coil, which can be removed in a few seconds with a screwdriver, and without unsoldering any of the connections. The entire operation of removing the drop coil is carried on from the rear of the board. The front view of the switchboard, shown herewith, demonstrates the accessibility of any line on the board, and it is only necessary to transfer connections from subscribers appearing in the first two panels to those appearing in the last two, or vice versa. This not only increases the speed of operation, but decreases the cost of operation.

Special attention has been paid to the maintenance of the equipment. It is an easy matter to change any drop coil without interfering with adjoining apparatus or in any way mutilating the cable forms. All cord terminals are conveniently located, and all other apparatus, such as condensers, repeating coils, and induction coils, are located on the hard-maple panel in the rear of each position. All terminals are lettered and numbered in accordance with a blueprint furnished with the switchboard.



NEW TYPE KELLOGG SWITCHBOARD.

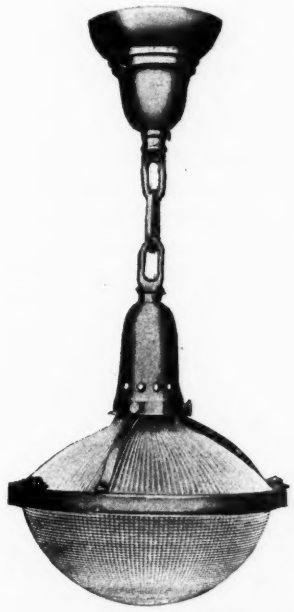
A New Holophane Reflector-Bowl Unit.

The accompanying illustration shows a new reflector-bowl unit, which has been placed on the market by the Holophane Company, Newark, Ohio.

This unit consists of a strong, concentrating reflector above the lamp, with a special Holophane hemisphere below. The prisms of the hemisphere are quite shallow, so as to reduce to the lowest possible degree any accumulation of dust.

The photometric curves show that the new unit gives a desirable distribution of light, ranging from seventy candlepower at forty-five degrees to fifty-five candlepower directly under the unit when equipped with sixty-watt clear-bulb tungsten lamps. The complete unit is at-

tractive in appearance and has a wide field of usefulness in office buildings, stores, clubs, etc., where good appearance,

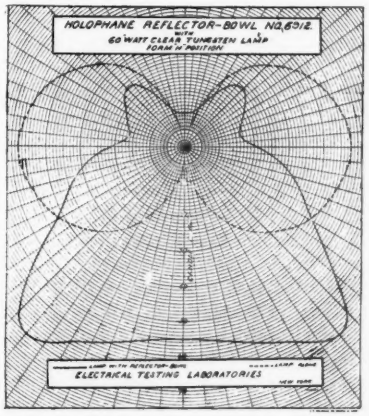


NEW HOLOPHANE REFLECTOR-BOWL UNIT.

efficiency and diffusion of light are of about equal importance.

New Types of Tungsten Lamps.

Julius Auerbach, president of the Electrical Accessaries Company, returned from Europe a short time ago, after visiting his tungsten-lamp factories. The "Just" tungsten lamp will be imported as heretofore by his company direct from Germany, under a special permit granted by the General Electric Company.

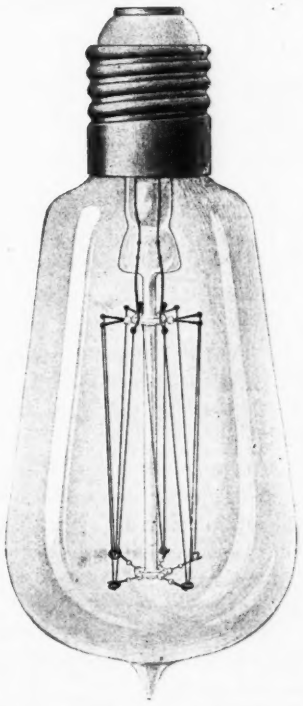


PHOTOMETRIC CURVES OF NEW REFLECTOR-BOWL UNIT.

Lamps will be marketed with a new trademark, as the Electrical Accessaries Company has decided to adopt the name of "Justram" for its lamps in the future, which indicates more clearly the Just wolfram lamp, which is so well known in Germany.

In addition to the usual standard types heretofore imported, the Electrical Accessaries Company is now also putting on the market the smallest unit made today for multiple circuits of 100 to 120 volts; this is an eighteen-watt lamp, and is shown in the accompanying illustration. The company is also bringing on the market the smallest lamp for 200 to 250-volt circuits of only forty watts. The first lamp should find a ready field, which has not been touched to any extent heretofore by the tungsten lamp; that is, for residential lighting, show-windows, etc., while the small, forty-watt, high-voltage lamp no doubt will be welcome by all users of high-voltage current, who have heretofore been obliged to burn two in series, no high-volt lamp of sufficiently small wattage having been supplied.

Another new lamp that is being put on the market by the above company is a 400-candlepower lamp, which is the largest tungsten lamp made today. This lamp no doubt will find a welcome field for replacing arc lamps, especially for alternating current, where the introduction of these lamps will do away with all the annoyances inherent in alternating-current arc lamps. While these lamps are all new to this country, they have been on the market in Europe sufficiently long to show that they are commercially perfect in every respect.



EIGHTEEN-WATT TUNGSTEN LAMP (NEW TYPE).

A New Ozonizer.

A new form of completely enclosed ozonizer, the invention of Samuel C. Shaffner, a Chicago engineer, is being marketed by the National Air Filter Company, of Chicago, and has been installed in several hospitals, as well as in many business places.

The machine is, of course, electrical and takes its current from the ordinary electric-lamp socket. Type "A" is suitable for halls, restaurants, theatres, etc.; type "B" for large offices and general use. The outer dimensions of both these are the same, fourteen inches by eighteen inches, as is the weight, 100 pounds.

The method of operation is as follows: An electric fan draws in air at the bottom at the rate of 500 cubic feet a minute. This air is forced through a gauze in which plays a blue, high-tension, electric discharge, which effectively kills off all the bacteria present in the air and transforms a large part of the oxygen into ozone. The purified, ozonized air is liberated through the perforated brass screen at the top. Type "B" takes a power of only thirty-four watts. The combined rotary converter and transformer step up from 110 volts to from 1,000 to 6,500 volts, as controlled by the regulator knob on the side. Types "A" and "B" are illustrated in Fig. 1. There is a smaller size, type "C," shown in Fig. 2, which is suitable for use in ordi-

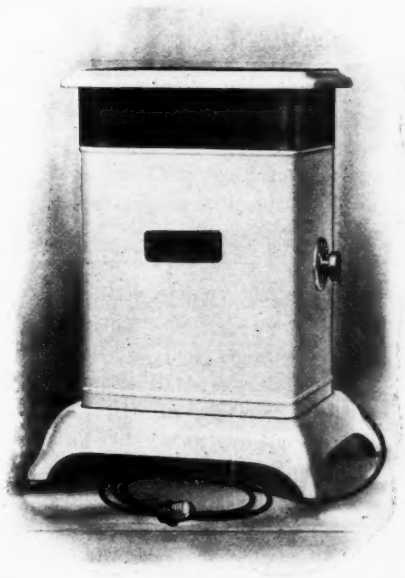


FIG. 1.—OZONIZER, TYPES "A" AND "B."

nary bedrooms and living rooms. This machine takes but seventeen watts, and the air circulation is effected by means of a heating device instead of by an electric fan.

The effect of one of these machines in a room is speedily made noticeable by the sea-breezy smell of the air. Even noxious fumes, tobacco smoke, etc., are quickly made to disappear. Owing to the fact that the electric discharge is quite cold, there are practically no poisonous nitrogenous gases produced, and

FIG. 2.—OZONIZER, TYPE "C."

as the machine is entirely enclosed the danger from electric shock is entirely eliminated.

These machines are being taken up for hospitals, hotels, residences, shipboard and many other places.

Electric Vehicle Settlement.

United States Judge Rellstab, on June 14, at Trenton, N. J., allowed the petition of Halsey M. Barrett and Henry W. Nuckels, receivers of the Electric Vehicle Company, to accept an offer of $430,000 cash from Herbert Lloyd, Kenneth B. Schley, and C. Wendell Woodward, representing the reorganization committee of this organization. The offer provides that the reorganization committee will also pay all of the accruing debts of the present receivership until its termination and the turning over of the property by order of the court in final judgment. The order is subject to confirmation by the Federal courts in Connecticut.

The concern makes automobiles and was incorporated in New Jersey with $20,000,000 capital stock, nearly all of which has been issued.

The Venus Miniature Arc Lamp.

The American Automatic Advertising Company, 105 Madison Street, Chicago, Ill., has placed on the market the Venus miniature arc lamp, an illustration of which is shown herewith.

This lamp is eighteen inches long, is

VENUS MINIATURE ARC LAMP.

suitable for all classes of lighting, and is particularly adapted to places having low ceilings. The consumption is given at 350 watts, 511 candlepower. Using a sand-blasted or Holophane globe a soft, mellow light is produced. The carbons are one-fourth-inch standard "Electra" carbons, burning thirty hours on one trim.

The lamp is manufactured for both indoor and outdoor use on alternating and direct-current circuits, 110 and 220 volts, or can be connected two in series on 220 and 440 volts.

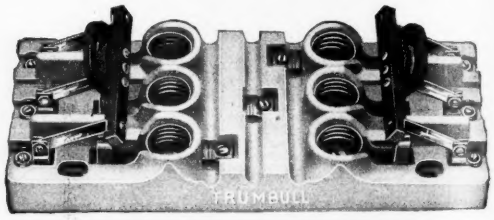
New Industry for Mexico City.

A plant for the manufacture of chemicals and steel products will be erected at Mexico City, at a cost of more than $1,000,000, by a Canadian syndicate, headed by Dr. F. S. Pearson, who is already largely interested in electrical enterprises in this country. The Mexico Steel and Chemical Company, which has been organized by Dr. Pearson and associates to carry on the industry, has obtained a concession from the Federal Government for the erection and operation of the plant, 100,000 square metres of land having been acquired.

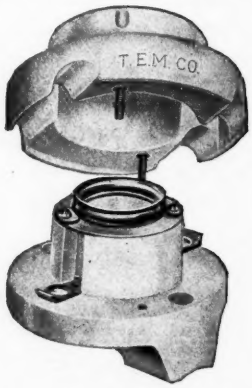
Three-Wire Panel Cut-Outs and Weatherproof Receptacles.

Among the new products of the Trumbull Electric Manufacturing Company that have been approved by the Underwriters' Association are the Trumbull three-wire, double-branch cut-out and the Trumbull weatherproof receptacle. The former is designed along standard lines, but is arranged for three-wire to three-wire work. The accompanying illustration gives an excellent idea of its construction.

The weatherproof receptacle embodies a number of interesting features. As its name implies, it has been designed for the most severely exposed situations. The separation between current-carrying parts of opposite polarity is at no point less than five-eighths of an inch. For use along the ocean beach it is believed that electrolytic action of salt-water spray is entirely avoided by this wide separation and all tendency to arcing overcome. All live parts are protected and there is no soldering or tapering of the lugs that might permit corrosion, grounds, arcing



THREE-WIRE PANEL CUT-OUT.



WEATHERPROOF RECEPTACLE.

or short-circuits. Without the recent improvements in strengthening the porcelain, and in other features, this receptacle, under another name, was used by the thousands in Luna Park, Coney Island, and gave excellent service. Where rugged construction and ability to withstand severe climatic conditions are essential, the company claims these devices are fulfilling all requirements.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JUNE 11.—It does not come as a surprise to hear that the G. B. Surface Contact Traction Company has decided to institute legal proceedings against the London County Council in respect of the experiments in the Mile End Road with this system of electric traction. The writs will be issued, in all probability, next week, but it will no doubt be some time before the case is reached in the courts. The position of the London County Council in this matter is a rather peculiar one, inasmuch as the system has been rejected against the advice of the independent expert who was employed in order to ascertain whether the system could or could not be worked under the conditions of London traffic. As is now well known, Mr. Mordey, the gentleman in question, advised the Council to continue with the system, but the Council preferred to follow the advice of its own permanent officials, which was against continuing.

The London electric-lighting companies and the borough councils, who own electricity undertakings, have appointed a committee to draw up the outlines of a scheme for linking the various electricity supply stations within the London area. Thus the work of last Parliamentary session is rapidly bearing fruit.

Patent litigation of great importance to the British arc-lamp industry is now pending. Following the recent decision of the High Courts that the British Westinghouse Company is working its arc-lamp patents in this country to an adequate extent, considering all the circumstances, that company has entered actions against two firms of importers and manufacturers of arc lamps here for infringement of patents. The British Westinghouse Company claimed in the previous action that one reason, and a very important one, for the comparatively small number of arc lamps which they had sold in this country hitherto, was the number of infringing lamps on the market, which were naturally being sold at a lower price. In the event of the company establishing their case in the first two actions mentioned above, it is the intention to proceed against a large number of other firms on the same grounds. It is claimed that practically every arc lamp sold in this country infringes the Bremer patents, although part of the case against the Westinghouse company will, I believe, be that their own Bremer patent is invalid as against the Hogner patent, to avoid litigation concerning which the Westinghouse company entered into an agreement with the owners, Messrs. Korting & Mathiesen, of Germany. The first action for infringement will come on in about ten days' time.

An example of the pushfulness of the electric power companies on the northeast coast of England was before the House of Commons last week. The power companies in this district asked for statutory authority to invest, when it seemed desirable, sums in trading companies in order to induce them to establish works in the area of the power companies, and so increase the output of the latter. Looked at from one standpoint, the investment of the capital of the power companies in this way might land them in difficulties which might prove fatal to their enterprise, while on the other hand it might be the means, if judiciously applied, of enormously increasing the business and bringing into profitable use many miles of mains which have been laid in anticipation. However, the House of Commons preferred to take the view that the "cobbler should stick to his last" and refused the powers asked for.

No less than three tube railway schemes were before Parliament this week, the promoters of which were seeking extensions of time in which to carry out their works, the capital for which has not been obtained owing to the very weak state of the money market during the past three years.

The Salford Corporation is following the example of the Manchester Corporation and intends to install a large storage battery substation. Tenders are now being invited for this.

In a paper read before the Society of Arts last week, the Birkeland-Eyde process for manufacturing nitrates from the atmosphere was described. It appears that there are now no less than thirty-six furnaces at the Notodden works of the company which is operating this system in Norway, the water-driven power house containing four 11,000-horsepower turbines, three-phase current at 10,000 volts and fifty perodicity being generated. In the discussion which followed the reading of the paper, the feeling was expressed that power could not be generated and sold at a sufficiently low figure in Great Britain to justify the working of the process here. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JUNE 12.—In France or the colonies I note the following projects for electrical work: It is proposed to build a system of tramway lines in the region of Bergerac, and a report has been presented upon the question. A hydraulic plant is to be erected at Perpignan, and this will probably be carried out by a local firm, the Rousillon Hydroelectric Company. An electric-light plant will be built at St. Dizier, and the plans have already been drawn up. Sfax, in Tunisia, is to have an increase in its central station, which at present contains three sets of machines. At Paris, the section of underground conduit in the heart of the city along the Rue du 4-Septembre is now finished, and the use of the provisory trolley line, which gave rise to so much discussion, will now be discontinued.

An electric-railroad project of considerable scope is to be developed in the near future in Austria. This relates to applying electric traction upon a section of the state railroad lines in the southern region, extending from Fiume, on the Adriatic, to Moravica. The government is considering the feasibility of the matter. Steam locomotives are at a disadvantage for handling the increased traffic, especially upon the twenty-five-per-cent gradients of the line, and electric locomotives would no doubt do three times the service. To supply the current for the section it is proposed to erect a 30,000-horsepower turbine plant upon the Zengg stream, and a local company has already made propositions for the building of the station. At the same time, the local electric plants of Fiume, Trieste, Abbazia and others will be called upon for a further supply.

Among the new companies formed in France are the following: La Regionale Electrique, at Grenoble; Renard and Gressier, electric-light and heating apparatus, at Boulogne-sur-Seine, near Paris; the Rhone Power Company, formed at Lyons, and the Pauzani and Bard Company, in the same city, for electric plants. At Lille there has been formed the Fors Accumulator Company.

Lieuts. Colin and Jeance have been making experiments in France in wireless telephony with a new system of their invention. The first tests of the apparatus were made between the Eiffel Tower and the town of Melun, covering about thirty miles. More recently the experiments took place in the Mediterranean region. One of the war vessels, the "Condé," was fitted with the apparatus, and the short station was located at the Toulon Arsenal. At first a distance of sixty-eight miles was covered, with the vessel lying out at sea. However, this was much increased in the last trials, and messages could be sent as far as 102 miles.

Among the Austrian projects, I note that a concession was granted by the municipality of Salzburg for a standard-gauge traction line running to the suburbs. Rights were granted for a short line of electric railroad from Budapest to the suburban town of Monor. The Mährisch-Ostrau electric road, running to the locality of Karwin, was opened for traffic not long since.

In France there are to be erected electric-light and power stations in the towns of Bagnolet and Romilly. A new company has been formed at Maurs, known as the Riom Electric Lighting Company. The Alais Electric Lighting Company, in the town of the same name, has increased its capital. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JUNE 19.—The Hydro-Electric Power Commission of Ontario is asking for tenders for two new transformer station buildings. The stations will be constructed, one in Niagara and the other at Dundas. The latter will be an interswitching as well as transformer station.

The statement submitted by the directors at the annual meeting, held in Toronto, of the Sao Paulo Tramway, Light & Power Company, of Brazil, contained many satisfactory features. The gross earnings for the year were $2,287,410, an increase over the previous year of $175,887, or 8.33 per cent, while the net earnings of $1,504,350 show an increase of $108,486, or 7.77 per cent. The surplus is $1,138,891, which added to the balance from last year left a total of $1,795,790. After payment of dividends and an amount carried to contingent account, a balance of $659,252 has been carried forward.

A contract for the supply of power has been entered into between the Montreal Electric Company and the Central Heat, Light & Power Company, both of the city of Montreal. The one company has the right to plant poles and string wires in the city streets, but has no power to transmit over them; the other concern has the electric energy, but not the charter rights which

enable its distribution through the city. The new contract will combine these interests, and permit the Montreal Electric Company, which for many years was popularly considered defunct, to enter into the lighting field in Montreal in competition with the big concern, the Montreal Light, Heat & Power Company.

Special advices received here from Domnarfvet, Sweden, announce that the company controlling the patent rights of the successful electric shaft furnace for the smelting of iron ores, and which was recently investigated on the spot by Dr. Haanel of Ottawa, for the Dominion government, has just contracted for the installation of three 2,500 horsepower electric shaft furnaces for the making of foundry pig at Trollhattan, Sweden. A second company has been formed, to be called the A. B. Trollhattans Elektriska Smaltverk, which will erect as soon as possible three of these furnaces. The 1,000 horsepower furnace working at Domnarfvet still gives perfect satisfaction. The works being erected in Norway, which will eventually have six furnaces of 2,500 horsepower, will very shortly be completed, so that the total capacity of the furnaces, in commission or on order, will be 21,000 horsepower, a record for six months unequaled in the history of electric furnace work. It is claimed that the success of the electric shaft furnace may be considered as indisputable, and that the question of the electric reduction of iron ore is at last solved. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, CANADA, JUNE 21.—The Calgary Power & Transmission Company, of Calgary, Alta, now has plans complete for its development at Horse Shoe Falls. It is estimated that the work to be undertaken by the company this year will cost approximately $700,000. Messrs. Smith, Kerry & Chace, civil engineers of Winnipeg, Man., and Toronto, Ont., are in charge of the work.

The Saskatchewan government has notified the town authorities at Hanley, Sask., of its intention to build a local telephone system there and work will be commenced during July. The government has already opened a long-distance exchange in that town and has placed G. F. Daintree in charge. A rural telephone company has been incorporated at Hanley under the name of the Hanley Rural Telephone Company and plans have been prepared for the construction of forty miles of line this year. D. M. Dilly is manager of the company.

The Manitoba Telephone Commission is calling for tenders for the erection of a new telephone exchange at Portage la Prairie, Man. F. C. Patterson, Winnipeg, Man., is chairman of the commission.

The British Columbia Telephone Company has decided to place all its wires in Victoria, B. C., underground. The city will finance the work to be done by the company and will bear one-tenth of the total cost. The company will also pay interest and sinking fund. It is expected the work will be commenced during July. Address Alderman Mable. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

PACIFIC TRACTION COMPANY FILES MORTGAGE—The Pacific Traction Company of Tacoma, Wash., has filed a mortgage to secure $5,000,000 bonds, the proceeds of which will be used for extensions.

CHATTANOOGA RAILWAYS COMPANY—A meeting of the stockholders of the Chattanooga Railways Company will be held June 30 to vote on the question of selling the road to a new company, which will take over the property and the Chattanooga Electric Company.

TO INCREASE CAPITAL STOCK—Application has been made to the New York Public Service Commission, Second District, by the New York State Railways, which has control of several up-state trolley companies, for permission to increase its capital stock from $23,140,200 to $23,860,200 to purchase and acquire the stock of various street railroad corporations; to execute a first consolidated and refunding mortgage upon its property, rights and franchises to secure $35,000,000 of coupon or registered bonds, and to issue at present $6,500,000 in bonds under this mortgage.

NORTHERN CONNECTICUT COMPANY TO ISSUE BONDS—The Connecticut House of Representatives has amended the charter of the Northern Connecticut Light and Power Company, so as to permit a bond issue of $350,000. This company is to handle the lighting and power merger based on the charter of the Enfield Gas Company, originally the Pynchon Land and Construction Company, and the power plant which the recently chartered Connecticut River Company purposes to erect on the Connecticut River above Windsor Locks, and will furnish light and power to the towns along the river between Hartford and Springfield. It is provided, however, that these bonds shall at no time exceed in amount the outstanding capital stock of the company.

THE PORTLAND RAILWAY, LIGHT AND POWER COMPANY—When completed, the new power plant planned by this company on Clackamas River will represent the most notable achievement of its kind on the Pacific Coast, besides increasing the available car-operating current of the company by 40,000 horsepower. More than two years will be required to complete the power plant, and its ultimate cost may go above the $2,500,000 now set aside for the purpose. First the Cazadero electric line must be extended three miles. The extension will lead directly to the site of the plant. Some of the material for construction will be brought across the Continent. When finished the dam will be 160 feet high, 450 feet wide and will hold a pool of water six miles long. It will be seventy-five feet thick at the base. Sellers & Rippey, the Philadelphia hydroelectric engineering firm, will have charge of the work. When the new plant is completed the company will have altogether 75,000 horsepower taken from the falls at Oregon City, the old plant at Cazadero and the new one three miles above.

LIGHTING AND POWER.

(Special Correspondence.)

EL RENO, OKLA.—The El Reno Gas and Electric Company is rebuilding its electric-lighting system.

WACO, TEX.—The Rotan Water and Light Company has been incorporated with a capital stock of $10,000.

BELLE PLAINE, MINN.—Arndt & Rockwelter have been granted a franchise for an electric light and power plant.

CARO, TEX.—The Saner-Whiteman Lumber Company will rebuild its power plant and install new electrical machinery.

MOUND CITY, MO.—The Mound City Electric Light and Ice Company has been incorporated with a capital of $25,000.

CHICKASHA, OKLA.—The Chickasha Hydro-Electric Power Company has been incorporated with a capital stock of $100,000.

PHŒNIX, ARIZ.—Local business men have started a project for the organization of a new electric-light and gas company.

EL RENO, OKLA.—The El Reno Gas and Electric Company is spending $10,000 on improvements for the electric-lighting system.

CONCORD, N. H.—The Connecticut River Power Company, of Hinsdale, has increased its capital stock from $2,500,000 to $3,220,000.

FRIDAY HARBOR, WASH.—The Pacific Electric Company, of Port Townsend, Wash., has applied for a fifty-year light and power franchise in this place.

ANTIGO, WIS.—F. A. Hecker, Charles M. Cleveland and John Manser have secured an option for the purchase of the Antigo Electric Power Company. C.

BELLE PLAINE, MINN.—An ordinance has been passed granting a franchise to Messrs. Arndt & Rockwater, St. Paul, Minn., to operate an electric plant. C.

MEXICO CITY, MEXICO—It is stated that damage to the power plant at Necaxa, ninety-five miles from there, on account of the recent cave-in, will reach $500,000.

EVERETT, WASH.—The Northwest Light and Power Company has been incorporated here, with a capital stock of $400,000, by P. E. Hall, Jr., G. W. Numaw and others.

BIG TIMBER, MONT.—The Madison River Power Company is extending its power transmission lines and Big Timber will shortly be supplied with electricity both day and night. C.

GLENDALE, CAL.—A special election will be held here on June 22 to vote on the proposition of issuing bonds to the amount of $60,000 for a municipal electric-lighting plant.

NORTH YAKIMA, WASH.—The Hydro-Electric Company, of this place, which plans to develop power from the waters of Yakima River, has applied for an electric-lighting franchise.

ST. HELENS, ORE.—The City Council has granted a 25-year electric-lighting franchise in this place to the McCormick Company, which has agreed to put in a plant, at a cost of $12,000.

EUREKA, CAL.—Mayor Ricks, of this city, has laid before the City Council plans for the erection of a power plant on the ocean front to develop power for the operation of a salt-water fire-protection system.

EASTHAMPTON, MASS.—The Connecticut River Power Company has bought the Easthampton Gas Company outright for cash. The new owners are planning improvements and better service, especially in the electric department.

MILTON, ORE.—By an almost unanimous vote, the taxpayers of Milton City for the second time have expressed their willingness that the mayor and City Council issue bonds to the amount of $15,000 for the extension of the city light and power plant.

GREENSBURG, IND.—Baseball is being played successfully after night in this city under the glare of fifty-candlepower elec-

tric lights. Prominent baseball men from Cincinnati and other cities have been here to investigate the plan of lighting a baseball park. S.

SULLIVAN, IND.—Judge Anderson, of the Federal Court at Indianapolis, has ordered that the Sullivan Lighting Company's plant be sold at public auction. July 1 is the day set for the sale. The plant is valued at $100,000 and there will be a host of bidders. S.

SHERIDAN, WYO.—Work has been started on the new power house of the Northern Wyoming Power Company. A structure large enough to funrnish over 5,000 horsepower of electricity for domestic and industrial purposes in Sheridan and adjacent territory is planned

CAMDEN, N. J.—The Eastern Light and Fuel Company has been incorporated to deal in and generate electricity for light, heat and power. The capital is $200,000, and the incorporators are W. B. MacDonald, Camden; W. E. Stokes and B. L. Van Schaick, Philadelphia.

NEW YORK CITY, N. Y.—There is much division of opinion among officials concerning the installation of an electric-light and power plant, at a cost of $102,000, in the New York public library. The commissioner of parks reports favorably, but the controller's engineers are against it.

MINNEAPOLIS, MINN.—Dr. P. M. Hall, health commissioner, suggests the installation of a large dynamo and increased boiler capacity at the garbage crematory in order to furnish power for at least 200 arc lights in the northern part of the city and thus effect a saving of $15,000 a year. C.

WALLA WALLA, WASH.—The Northwest Corporation, the holding company for the Walla Walla Lighting Company and the Walla Walla Valley Traction Company, announces plans for a power plant and substation, to cost $100,000, and for an office building and depot, to cost $50,000.

RICHMOND, VA.—The Suffolk Light Company, Suffolk, Va., has been incorporated. The officers are W. L. Williams, president; R. B. Tunstall, vice-president; A. R. Williams, secretary and treasurer—all of Norfolk. Capital: Maximum, $250,000; minimum, $500. Object, a light and power plant.

FORT FRANCES, ONT.—The first units of the great hydraulic power plant, which is nearing completion here, will likely be turned on in August. As a result many large industries are already being established in the neighborhood, and it is stated that many more big industrial concerns are being contemplated.

SHEBOYGAN, WIS.—At the annual meeting of the Sheboygan Light, Power and Railway Company all the officers were re-elected with exception of president. They are: E. Gozenbach, first vice-president and treasurer; W. O. Morgan, second vice-president; J. O. Chesney, secretary, and Aug. Westermeyer, assistant secretary. C.

HICKORY, N. C.—Col. M. E. Thornton, president of the Water Power Electric Company, Hickory, N. C., is planning the erection of a large cotton factory in connection with his company's waterpower electric development. No final details have been determined, but it is reported that Colonel Thornton has arranged to secure the capital for both enterprises.

LOS ANGELES, CAL.—The Lytle Creek Power Company has filed a certificate of bonded indebtedness to the amount of $300,000. The proceeds of the bonds will be used in retiring all present indebtedness including the refunding of the present bonded indebtedness, and in acquiring lands, water rights and machinery. The issue will consist of 300 $1,000 bonds, bearing 5 per cent interest.

EASTHAMPTON, MASS.—Negotiations are on foot between the Easthampton Gas Company and Peabody & Davis, of Boston, with respect to the sale of the plant of the local company to the Connecticut River Power Company. If the transfer is made, it is probable that the electric lines of the gas company will be connected with the power plant of the Connecticut River Company at Turners Falls.

DULUTH, MINN.—The Virginia Electric Power and Water Company, which will begin at once the construction of an electric generating plant at Virginia, has been incorporated. The capital, at $200,000, will be furnished, it is understood, by Duluth and range capital. The nominal incorporators and directors are: W. K. McLennan, Arthur H. Brown, William Elder, Arthur Howell and M. E. Riley, all of Duluth.

ABBEVILLE, ALA.—The Abbeville Power and Manufacturing Company has been incorporated with $500,000 capital stock by J. L. Pollard, C. J. Owens and others to build a waterpower-electric plant on Abbey Creek, eight miles north of Abbeville. The company will develop 8,000 horsepower for transmission by electricity to Abbeville, Dothan, Eufaula, Wells and Columbia, each in Alabama, and Fort Gaines and Blakeley, in Georgia. A cotton mill will also be built.

SAN FRANCISCO, CAL.—The Municipal Light and Power Company has been incorporated here, with a capital stock of $1,000,000, by Rudolph Spreckels, Claus A. Spreckels, P. S. Scales, J. S. Sandford and Frank Harrold. The company will take over and extend the Spreckels plant on Jesse Street, near Third. This is in the heart of the business section of the city and is furnishing light and power to a number of large office buildings and hotels.

GENEVA, ALA.—The Geneva Power and Manufacturing Company will be incorporated with a capital stock of $500,000 to build a cotton factory and a hydroelectric plant. This latter will be on Double Bridge Creek, six miles from Geneva, and is to transmit 5,000 electrical horsepower for operating the cotton mill and for lighting and power in other plants in the vicinity of Geneva. D. O. Vaughan, D. G. McInnis, D. H. Morris and A. M. McKinnon, all of Geneva, are promoting the company.

EVANSVILLE, IND.—It is announced that the stock of the Evansville Light Company, a $3,000,000 corporation, which owns the Evansville Gas and Electric Light Company, is being bought up with the ultimate purpose of consolidating with the Union Railway, Gas and Power Company, a new concern, which proposes to issue $8,000,000 in bonds and preferred stock and $6,000,000 common stock. Similar companies at Springfield, Ill., Peoria, Ill., and Rockford, Ill., will also be merged with the new concern.

CROOKSTON, MINN.—The Kiewel Brewing Company has decided to discontinue the use of steam power entirely, substituting electricity as a motive power. The change has already been made on a portion of the plant, and the refrigerator plant is now operated by electricity. Within a couple of weeks the use of steam will be discontinued entirely and electric motors installed in their place. This will not only be cheaper but will be more economical as well. The brewery is now one of the most modern institutions in the state.

MONROE, N. C.—The town has voted $20,000 bonds to fund a debt on the town's electric-lighting plant, and to meet the financial requirements of an agreement with the Southern Power Company, which is entering Monroe with its transmission lines from hydroelectric developments along the Catawba River in South Carolina, and the Southern Power Company is now ready to furnish the town lights and to offer the electric current for manufacturing purposes, several large private contracts having been negotiated as a starter. L.

BUFFALO, N. Y.—Stockholders of the Niagara Falls Power Company have authorized the placing of a mortgage or deed of trust upon the company's Canadian and American property, rights, privileges and franchises to secure a six per cent bond issue of $25,000,000, payable January 1, 1932. Certain debentures mature between April, 1910, and November, 1914, and the directors, in connection with their refunding, considered this an opportune time to deal with the question of financing additional construction on the Canadian side.

WILLIMANTIC, CONN.—A controlling interest in the Willimantic Gas and Electric Light Company has been acquired by the Alden M. Young syndicate. Boston interests have hitherto dominated the concern, but their holdings have been taken over by the new owners. President Jesse F. Church and Secretary C. Winfield Noyes have resigned. Alexander J. Campbell, manager of the New London Gas and Electric Company, will be the general manager of the Willimantic concern, but will retain his position with the New London corporation.

KENOSHA, WIS.—In open defiance to the state railroad commission and the public utility law of the state of Wisconsin, the Kenosha Common Council has granted a lighting franchise to the Kenosha Electric Railway Company. It is claimed the granting of the franchise will result in the public utilities act being tested in the Supreme Court. The Council was advised by its attorney that it could not grant a valid franchise without first getting a permit from the railroad commission, but, in defiance of this opinion, the franchise was granted by unanimous vote.

NORTH ADAMS, MASS.—The Massachusetts Lighting Company, owner of the North Adams, Adams, Williamstown and Stamford (Vt.) companies, has the preliminary plans for the erection of a steel power house for the electrical part of the plant about completed. The new plant, which will be built on the site of the old one, will be completed, it is planned, within the next five months. Turbine engines will be installed and placed on the first floor of the new plant, while it is possible that two or more of the old engines will be kept as auxiliary engines.

ELBERTON, GA.—Application has been made for the incorporation of the Interstate Power Company by Thos J. Brown and E. Marvin Underwood, of Fulton County, with offices in Elberton. The capitalization will be $3,000,000 with privilege of increasing to $5,000,000. It is proposed to build a dam across the Savannah in Elbert County, thus giving three extensive developments on the Savannah at no great distance apart, the other two developments being the Gregg's Shoals Power Company, on the South Carolina side, and the Twin City Power Company, located in Lincoln County. L.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MASON CITY, IOWA—A new electric railway to Waterloo is projected. C.

SACRAMENTO, CAL.—The Central California Traction Company has begun work on its line between this city and Lodi, Cal.

CEDAR RAPIDS, IOWA—The Cedar Rapids & Iowa City Railway and Light Company has increased its capital stock from $2,000,000 to $2,300,000. C.

DECATUR, IND.—The Ft. Wayne & Springfield Traction Company has completed an extension of twelve miles and is now operating regular hourly cars thereon. S.

DES MOINES, IOWA—The net earnings for the first year's business of the Fort Dodge, Des Moines & Southern Interurban Railway Company amounted to $84,036. C.

LA MESA, N. M.—O. H. Bowen and others have been granted a franchise for an electric railroad between Las Crusas, Messilla Park and other points in the vicinity.

PEKIN, ILL.—The secretary of state has issued a license to incorporate the Oil Belt Traction Company, which intends to construct a line from Charleston, Ill., to Bridgeport, Ill.

HUNTERS HOT SPRINGS, MONT.—James A. Murray, of Butte, will build an electric line, two miles long, to connect his hotel with the Northern Pacific Railway at Springdale. C.

NAMPA, IDAHO—The Boise Valley Railway Company's tracklaying in Nampa is about finished, and by August 1 there will be a through line from Boise City to Nampa in operation.

SAN DIEGO, CAL.—Actual construction work on the San Diego and Arizona Railway has been started. Under the terms of the contract the work must be completed within six months.

GRAND RAPIDS, MICH.—The contract for the grading and construction work on the electric line between this city and Nekoosa has been let to the Knox Construction Company of Chicago.

NOBLESVILLE, IND.—For the second time the Lake Erie & Western Railroad will attempt to compete with the interurban cars by putting on a number of local trains between this city and Indianapolis. S.

ABERDEEN, S. D.—A. L. Ward and others have applied for a franchise to construct a street-car line. More than $60,000 worth of stock has been subscribed to a local company organized for this purpose. C.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company is making extensive improvements in its tracks throughout the Borough of Brooklyn. The work will entail a total expenditure of about $1,000,000.

NEWBERN, N. C.—A franchise for an electric street railway in Newbern has been granted by the City Council to Messrs. R. P. Foster, R. A. Nunn, their successors and assigns, for a period of thirty years.

OAKLAND, CAL.—The Board of Supervisors of Alameda County have granted the Oakland & Antioch Railway Company the right to use a portion of the Alameda County end of the Alameda and Contra Costa County tunnel.

PITTSBURG, PA.—Stockholders of the Philadelphia Company and the Pittsburg Railways have elected directors. George E. Tener was elected to the board of the former company to fill a vacancy caused by the death of Joshua Rhoades.

BROOKLYN, N. Y.—The South Flatbush Railroad Company has applied to the Public Service Commission for a certificate of public convenience and necessity for the construction of its proposed railroad, and also for permission to make a $30,000 stock issue.

NEW YORK, N. Y.—The Public Service Commission has refused to approve the franchise granted by the Board of Estimate to the South Shore Traction Company, permitting that company to build a new trolley road from Jamaica to and across the Queensboro Bridge.

ELLENSBURG, WASH.—The County Commissioners have granted the Sheelum-Roslyn Electric Railway and Power Company an electric-railway franchise through this county, a distance of seventeen miles. The road is to be commenced this year and to be finished before December 1, 1911.

YOUNGSTOWN, OHIO—Construction on the Lake Erie and Youngstown, an interurban line which will run from Conneaut, through Andover and other intermediate points, to Youngstown, will be started within the next thirty days. The cost of construction and the equipment will be $3,000,000.

GUTHRIE, OKLA.—The Okmulgee Interurban Railway Company, with $200,000 capital stock, has been chartered here to build a street-car system in the city of Okmulgee and a line to an amusement park outside the city. The length of the line is to be eight miles and its estimated cost is $150,000.

COLUMBUS, IND.—A. A. Anderson, superintendent of the Indianapolis, Columbus & Southern Traction Company, has established a school of instruction among the employes of the road. The men are ordered up once a week for examination relative to the rules and methods of operation on the road. S.

INDIANAPOLIS, IND.—The Indiana Union Traction Company has put a new schedule of rates into effect. Excess fare will not be charged for passage on limited cars. The C. E. T. A. thousand-mile book will be the only mileage book sold, and this is good on any interurban road in Indiana and Ohio. S.

FT. WAYNE, IND.—The Ft. Wayne & Wabash Traction Company has placed an order with the General Electric Company for a 500-kilowatt portable substation, built on an all-steel car. It will be the first one of that type ever turned out, and is expected to prove a valuable adjunct to the power equipment of that system. S.

SPRINGFIELD, ILL.—The Jacksonville-Springfield Electric Railway will be under construction within two weeks. Under the ownership of New York and Chicago capitalists, the road will rapidly be rushed to completion, and it is stated cars will be in operation by October 1. The building of the line will entail a cost of $1,200,000.

GREENWOOD, IND.—The Indianapolis, Columbus & Southern Traction Company has built a new electric locomotive in its shops at this place. The electric locomotive is sixteen feet long and weighs twenty-five tons. The locomotive is capable of hauling a heavily loaded train of six cars of gravel. The locomotive will be used for repair work. S.

ALLENTOWN, PA.—The South Bethlehem & Saucon Street Railway Company, which runs through one of the finest sections of the county, connects with the Allentown & Philadelphia line at Centre Valley, at Fourth and New streets, South Bethlehem, with the Lehigh Valley Transit Company, and with the Easton Transit Company, has been opened for traffic.

INDIANAPOLIS, IND.—At the annual meeting of the stockholders of the Indianapolis Traction and Terminal Company, June 10, the following officers were elected: President, Hugh J. McGowan; vice-presidents, H. P. Wassan, John J. Appel, E. B. Peck, M. S. Morgan and Robert I. Todd; secretary-treasurer, W. F. Milholland; assistant secretary, J. A. McGowan. S.

SPARTA, WIS.—The Sparta-Melrose Electric Railway Company is now engaged on actual construction work. Over three-fourths of the right-of-way is now secured, and in a few days the remaining rights not secured will be subjected to condemnation proceedings. Orton & Horn of New Lisbon have secured the contract for the first five miles of grading out of Sparta.

NEW CASTLE, IND.—Benjamin Utt, a motorman of this city, has invented and patented a contrivance by which waiting passengers can signal an interurban car after night. It consists of a hollow semaphore arm bearing a series of incandescent lights, and the word stop on the sides. The car in passing automatically extinguishes the lights, but not until the passenger has boarded the car. S.

SAN JOSE, CAL.—The City Council has ratified the sale of the fifty-year street-railway franchise bought by J. T. Burke for the Harriman railway interests a few days ago. The franchise calls for a broad-gauge standard electric railroad, construction to begin within three months and be completed within two years. After the first five years, two per cent of the gross earnings are to go to the city.

SPRINGFIELD, ILL.—The Illinois Traction System is starting work on the new belt line and loop around this city. The loop will be built at an expense of $350,000. It will be used exclusively for freight traffic and will greatly facilitate the handling of the freight business of the road. At present the road is carrying but little freight, the city prohibiting the operating of freight cars through the city in the daytime. This obstacle, which makes it impossible for the line to engage in the freight-handling business on a broad scale, will be overcome with the new improvement, and as a result the freight-carrying capacity of the road will be unlimited.

INDIANAPOLIS, IND.—At a meeting of representatives of practically all the interurban roads of Indiana, recently held in the Traction Terminal Building here, to consider the proposition of free baggage, it was unanimously voted that a committee be appointed to draw up rules and regulations to be referred to the various roads of the state for their official approval. It is believed now that practically all, if not every road in Indiana, will adopt the recommendation of this committee and put into effect regulations which will mean practically free baggage. Rules for excess baggage will follow the same lines as those now in effect on the steam roads.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MILFORD, IOWA—The Midland Telephone Company has increased its capital stock to $50,000. C.

KALISPELL, MONT.—Eastern capitalists are constructing an independent telephone system here. C.

MINNEAPOLIS, MINN.—Telephones have been installed in the elevators in the Donaldson Building. C.

GREAT FALLS, MONT.—The Montana Independent Telephone Company is to erect a new building. C.

SAC CITY, IOWA—S. M. Elwood will erect a new exchange building for the Elwood Telephone Company. C.

LEAD, S. D.—The Nebraska Telephone Company is constructing a twenty-two-mile line to Rockford.

HURON, S. D.—The Huron Municipal Telephone Exchange has been incorporated with a capital stock of $50,000.

HAMPTON, IOWA—The Iowa Telephone Company will shortly commence the erection of a new central office. C.

IOWA FALLS, IOWA—The Iowa Telephone Company will re-equip its exchange and install a central energy plant. C.

PINE RIVER, MINN.—The Pine River Rural Telephone Company will install an exchange and will run a line to Emily.

NIOBRARA, NEB.—The Hill Independent Telephone Company has been incorporated with a capital stock of $10,000.

BURR OAK, KAN.—The Red Line Mutual Telephone Company has been incorporated with a capital stock of $10,000.

OAKLAND, NEB.—The Oakland Independent Telephone Company has been incorporated with a capital stock of $25,000.

CRAWFORD, NEB.—The Farmers' Independent Telephone Company has been incorporated with a capital stock of $30,000.

FORSYTH, MONT.—The Rocky Mountain Bell Telephone Company is extending its system through the Bitter Root Valley. C.

FORT BENTON, MONT.—The Co-operative Telephone Company, of Choteau County, has been organized with a capital of $40,000 to cover various sections of the county. C.

TURLOCK, CAL.—The Turlock Telephone Company has been incorporated, with a capital stock of $50,000, by J. L. Randolph, J. C. Williams, A. J. Eddy, L. J. Gamwell and J. H. Miller.

MARTINSVILLE, IND.—The Citizens' Telephone Company has decided to erect and equip a new exchange building and extend the lines throughout Morgan and adjacent counties. S.

BOONE, IOWA—The Boone County Telephone Company has let the contract to the Automatic Electric Company of Chicago, for the installation of a complete automatic telephone equipment at a cost of $125,000. C.

SAN FRANCISCO, CAL.—The Universal Wireless Telephone and Telegraph Company has been incorporated here, with a capital stock of $500,000, by J. H. McCarty, M. K. Miller, J. P. McCarty, F. P. Medina and F. P. Herguth.

DECATUR, ALA.—The American Telephone & Telegraph Company will soon commence the construction of a new rural line running a distance of fifteen miles westward from the Decaturs. Many farmers have already subscribed for telephones along the line.

GLASGOW, MONT.—The Moore Telephone Company has been organized with L. W. Gibson as president; R. G. Moore, vice-president; C. O. Moore, secretary and treasurer. The company has placed large orders for material and will extend its lines west. C.

MONMOUTH, ILL.—Announcement is made by Manager M. C. Broderick, of the Central Union Telephone Company, that a new telephone exchange is soon to be erected in this city, at a cost of over $60,000. The first floor of the John H. Hood Building, which is in the process of construction at the corner of South First Street and First Avenue, has been leased by the Bell Company and a thoroughly modern and up-to-date system will be installed.

MOLINE, ILL.—A merger of all the farmers' telephone lines and companies in southern Whiteside and Bureau counties is being agitated at present by the officials of the various companies, and the idea is meeting with considerable encouragement. The merger would include the Tampico Farmers' Mutual Telephone Company, the Bureau County Mutual, the Deer Grove Mutual and the Yorktown-Thomas-Hooppole and Tampico line. The consolidation, if effected, would make one of the strongest farmers' or mutual lines in the state.

CHARLESTON, W. VA.—The National Telephone Corporation, with a capital stock of $15,000,000, has been incorporated here. The promoters of the new company hope that it will become a rival of the Bell system in its long-distance business. The new concern has purchased or secured options on many independent telephone lines of Pennsylvania, Ohio and West Virginia. Pittsburg will be the principal office, and John A. Howard, of Wheeling, W. Va., backed by New York and Boston capitalists, is the leading spirit in the new concern.

NEW BRITAIN, CONN.—The Farmington Valley Telephone Company, an independent organization, has begun in the Hartford County Superior Court an action looking to the restoration of its service in New Britain. It has filed a petition asking the court to certify that public necessity and convenience require the operation of its lines in New Britain. The company, which operates in several towns in the Farmington Valley, formerly did a small business in New Britain, but two years ago, in consequence of its refusal to comply with certain orders passed by the Common Council with reference to poles and wires, the city authorities summarily cut the wires and removed the poles, thus shutting off the New Britain service.

NEW PUBLICATIONS.

THROOP POLYTECHNIC INSTITUTE, PASADENA, CAL.—This institute, which has an electrical engineering course, has issued its quarterly supplementary catalogue number, dated April, 1909, containing the new courses of study, the roster of students, and general information.

RESULTS OF MAGNETIC OBSERVATIONS MADE BY THE COAST AND GEODETIC SURVEY—The United States Coast and Geodetic Survey has recently published in five separate volumes the results of observations made at the magnetic observatories at Cheltenham, Md., in 1901-1904, at Baldwin, Kan., in 1901-1904, near Honolulu, Hawaii, in 1902-1904, at Sitka, Alaska, in 1902-1904, and at Vieques, Porto Rico, in 1903-1904. In each of these volumes there is given a description of the observatory buildings and equipment as well as the methods used and the data obtained. The complete set of these five volumes comprises some 674 pages.

UNIVERSITY OF ILLINOIS, ENGINEERING COLLEGE—Bulletin No. 21, Vol. VI, handsomely illustrated, describes the work and equipment at Urbana, Ill. The College of Engineering comprises eight departments. Among the buildings are an engineering hall, an electrical engineering laboratory, wood shops, pattern shops, metal shops, machine shops, a foundry, a forge shop, a mechanical engineering laboratory, an experimental boiler plant and a York ice and refrigerating machine. This particular bulletin is confined to illustrations of exteriors and interiors and students at work, also specimens of designs made by them. It gives a very comprehensive idea of the size and extent of the university's buildings and the wonderful progress made in the last few years.

ELECTRICAL SECURITIES.

The condition which the market had been preparing for some weeks came about last week, and the smartest declines that have been realized for some time took place. While there are many explanations being given for the break, it is expected that the real reason is that the market was topheavy and fell over of its own accord. It is expected that the bull movement had been carried too far with all favorable conditions discounted, and the present setback is a healthy indication that conservative buyers are not to be led into the snare of capitalizing futures too heavily. Business conditions warrant the prospect of continued activity, and the healthy demand for manufactured products of every description, taken together with the low cost of material and the highly efficient conditions of organization, indicates higher net returns, even though the gross do not make record figures.

ELECTRICAL SECURITIES FOR THE WEEK ENDED JUNE 19.

New York:	*Closing.*
Allis-Chalmers common	15¾
Allis-Chalmers preferred	52
American Tel. and Tel. Company	140¾
Brooklyn Rapid Transit	78¼
General Electric	160
Interborough-Metropolitan common	16⅝
Interborough-Metropolitan preferred	47½
Kings County Electric	125
Mackay Companies (Postal Telegraph and Cables) common	80
Mackay Companies (Postal Telegraph and Cables) preferred	71½
Manhattan Elevated	143
Metropolitan Street Railway	25
New York and New Jersey Telephone	114
Western Union	73¼
Westinghouse Manufacturing Company	83½

The Westinghouse Electric and Manufacturing Company is operating about 75 per cent of its capacity, and business is increasing gradually. It is expected that before the close of the

current year normal operations will have been reached. Full operations mean much larger earnings than several years ago, due to lower operating costs and a larger working capital. The cash balance of the company is in the neighborhood of $11,000,000. The annual meeting of the Westinghouse Electric and Manufacturing Company will be held July 28.

The Allis-Chalmers Company is now operating about seventy-five per cent of its capacity and is continually adding to its force. The low mark in operations reached during the depression was about fifty per cent of capacity. The most marked change lies in the orders booked, which on account of the improvement over the last four months, will probably reach seventy per cent of the business taken during the years 1907 and 1908. During the present fiscal period, the company has booked forty per cent more orders than during the last fiscal year. The Allis-Chalmers Company shows a substantial gain in shareholders. There are now 2,079 shareholders of record, compared with 1,666 just prior to the panic, an increase of about twenty-five per cent.

Boston:	*Closing.*
Edison Electric Illuminating	248
Massachusetts Electric	67½
New England Telephone	131
Western Telephone and Telegraph pref.	85
Philadelphia:	*Closing.*
Electric Company of America	12¼
Electric Storage Battery common	52½
Electric Storage Battery preferred	52½
Philadelphia Electric	11⅞
Philadelphia Rapid Transit	29½
United Gas Improvement	88¾
Chicago:	*Closing.*
Chicago Telephone	134
Commonwealth Edison	119
Metropolitan Elevated preferred	50
National Carbon common	93
National Carbon preferred	117

Dividends have been declared upon the following electrical securities:

American Cities Railway and Light Company; the regular quarterly dividend of one-and-one-half per cent of the preferred stock and one per cent on the common stock, payable July 1 to stock of record June 21.

American Telephone and Telegraph Company; the regular quarterly dividend of two per cent, payable July 15 to stock of record June 30.

Bell Telephone of Canada; the regular quarterly dividend of two per cent, payable July 15 to stockholders of record June 25.

Carolina Power and Light Company; a regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable July 1 to stock of record May 31.

Cumberland Telephone and Telegraph Company; the regular quarterly dividend of two per cent, payable July 1 to stock of record June 21.

Duluth Edison Electric Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable July 1 to stock of record June 15.

East Pennsylvania Railroad Company; a semiannual dividend of three per cent, payable July 20 to stock of record July 10.

Electric Light and Power Company of Abington and Rockland; semiannual dividend of $4 per share, payable July 1.

Electric Storage Battery Company; the regular quarterly dividends of three-quarters of one per cent on the preferred stock and three-quarters of one per cent on the common stock, the same as three months ago, payable July 1 to stock of record June 24.

Indianapolis Street Railway Company; three per cent, payable July 1.

Philadelphia Company; the regular quarterly dividend of one-and-one-half per cent on the common stock, payable August 2 to stock of record July 1.

Puget Sound Electric Railway; semiannual dividend of $3 per share, payable July 1.

Reading Traction Company; a semiannual dividend of seventy-five cents, payable July 1 to stock of record June 15.

Sao Paulo Tramway, Light and Power Company; the regular quarterly dividend of two-and-one-half per cent, payable July 1 to stockholders of record June 21.

Shawinigan Water and Power Company; the regular quarterly dividend of one per cent.

Tri-City Railway and Light Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable July 1 to holders of record June 22.

United Traction Company of Pittsburg; a semiannual dividend of two-and-one-half per cent on the preferred stock, payable July 20 to stock of record July 10.

Washington Water Power Company; the regular quarterly dividend of one-and-three-quarters per cent, payable July 1.

Wilkesbarre Gas and Electric Company; a dividend of one per cent, payable July 1 to stock of record June 15.

EDUCATIONAL NOTE.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SCHOOL OF ELECTRICAL ENGINEERING—Dr. Harold Pender has been appointed to the professorship of theoretical and applied electricity. Doctor Pender is a graduate of Johns Hopkins University, where he studied under Professor Rowland. He taught thereafter for a year and a half, during which time he completed Rowland's classical experiments on the magnetic effect of a moving charge of electricity. These experiments he repeated in France at the request of Professor Poincaré of Paris. Since his return from France, Doctor Pender has been in the employ of the Westinghouse Electric Company and has since been in regular engineering employ. The advanced lectures on the organization and administration of public service companies, on the design of power stations and systems, and on electrical measurements heretofore carried on by Professor Jackson, Professor Shaad and Professor Laws will be continued by the same professors. This organization makes a remarkably favorable one for graduate students of adequate preparation who propose to spend one, two or three years in advanced study of the greater problems of electrical engineering. As indicating the trend of electrical engineering study at the present time, it is notable that forty per cent of the students just graduated from the electrical engineering course at the Massachusetts Institute of Technology already bore degrees of Bachelor of Arts or Bachelor of Science conferred, as a rule, in classical or literary courses.

PERSONAL MENTION.

O. T. BOYD, formerly connected with the Pennsylvania Railroad, has been appointed general agent of the Hudson & Manhattan Railroad Company.

J. W. WILMOT, Controller of the Post Office Telegraph Factories in England, resigned last month after a career of forty-seven years in the telegraph service.

W. E. TEMPER, wire chief for the West Cincinnati Exchange at Cincinnati, Ohio, has resigned to become manager of the local exchange of the Mutual Telephone Company, at Ames, Iowa. C.

E. E. LEE, formerly one of the Commonwealth Edison Company's engineers, Chicago, is now doing big things for the government by helping Mr. Schildhauer on the canal work at Panama.

HARMAN S. SALT, 114 Liberty Street, New York, N. Y., has been appointed New York representative of Mathias Klein & Sons, Chicago, manufacturers of linemen's construction tools.

H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, New York city, has returned from Europe, where he found a general satisfactory condition in the flaming arc lamp field and many developments of great interest.

MME. SKLODOWSKA CURIE, of Paris, has been awarded the Elliott Cresson Medal by the Franklin Institute in recognition of the invaluable services that she and her late husband have rendered to science, and as a tribute to the memory of M. Pierre Curie.

S. FRED SMITH, who was elected a member of the executive board of the National Electric Light Association at the Atlantic City convention, is an official of the Salem Electric Lighting Company, of Salem, Mass., and president of the New England section of the national association.

H. H. CUDMORE, president of the Brilliant Electric Company, who, up to the time of his connection with this company, was actively associated with the Ambos-Cudmore Company, selling agents, Cleveland, Ohio, representing a number of electrical manufacturers, announces that he is not in anywise connected with the latter company at this time.

F. U. BLISS, for the past two-and-a-half years purchasing agent for the Seattle-Tacoma Power Company, has resigned this position to conduct a general electric supply, fixture and specialty business under the style of "The Bliss Electric Company, Incorporated," which he recently organized with a capital of $25,000. The new business will be located at 215 University Street, Seattle.

E. L. CALLAHAN, sales manager of electric heating appliances for the General Electric Company, Chicago, has resigned from that company to take up a position with H. M. Byllesby & Company, Chicago. Mr. Callahan is a graduate of the Case School of Applied Science, class of 1900, and although only thirty-four years of age, has built up an enviable reputation among electrical men for his successful efforts in promoting the sale of electrical heating appliances to central-station men and in showing the latter how to utilize these appliances for day loads. His past experience, which includes work with the Westinghouse, Church, Kerr & Company in connection with the electrification of the Pennsylvania tunnel, an assistant managership for three years with the Simplex Electric Heating Company, and a managership for two-and-one-half years with the Prometheus Electric Company, besides his three-and-one-half years' experience with the General

Electric Company, well qualifies Mr. Callahan for his new work, in which he will have charge of the business campaigns of the various electric-light, railway and gas properties controlled by the Byllesby company.

L. P. BRENENRIDGE, who has been professor of mechanical engineering at the University of Illinois since 1893 and director of its engineering experiment station since 1905, was tendered a farewell dinner at the City Club in Chicago on the evening of June 21 by the engineering alumni of the university from Chicago and vicinity. Professor Brenenridge spoke of the new work he will take up in the fall as director of the department of mechanical engineering of the Sheffield Scientific School at Yale University and declared he will maintain a keen interest in the university work at Urbana and Champaign, Ill.

E. DONALD ROBERTS, winner of the $1,000 Eastman kodak prize for photographic advertising, has become a member of the firm of the Curtis Advertising Company. This important connection means not only a valuable addition to the personnel of the Curtis Advertising Company, but increases the facilities for Mr. Roberts' work, as the company is about to move into a new and fully equipped building so as to handle better its large and growing business. The company is in charge of the advertising and publicity campaigns of a large number of central stations and manufacturers in the electrical industry.

HOWARD ADAMS CARSON, who built the Tremont Street subway, the East Boston tunnel and the Washington Street tunnel, in Boston, Mass., has resigned as chief engineer of the Boston Transit Commission. The resignation was tendered voluntarily by Mr. Carson so that he might have rest and time for study, he having been busy with important works for the facilitation of travel in Boston and connected with other large undertakings, as well as being an active worker in several widely known organizations and institutions during the fifteen years he has been with the Commission. Previously he was engaged in other important construction works in Massachusetts and elsewhere. It is understood that he contemplates traveling for study.

J. H. DAVIS has been promoted from assistant electrical engineer to electrical engineer of the Baltimore & Ohio Railroad, to succeed L. T. Gibbs, who died some months ago. Mr. Davis is not yet thirty-five years of age, having been born at Memphis, Tenn., October 7, 1874. He attended the University of Arkansas, where he studied both civil and electrical engineering, receiving his degree as electrical engineer in 1897. From that time until March 17, 1901, he was associated with the St. Francis Levee Board, doing dike and levee work along the Mississippi River, under the supervision of the United States Army. From March, 1901, until October, 1905, when he entered the Baltimore & Ohio service, Mr. Davis was connected with the electrical department of the Pennsylvania Railroad, at Altoona, Pa.

PROPOSALS.

POST OFFICE, SHENANDOAH, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 21, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Shenandoah, Iowa, in accordance with the drawings and specification, copies of which may be had from the custodian at Shenandoah, Iowa, or at the Supervising Architect's office.

POST OFFICE, PLATTEVILLE, WIS.—The office of the Supervising Architect, Washington, will receive sealed proposals until 3 o'clock p. m., July 26, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Platteville, Wis., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Platteville, Wis., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, MOSCOW, IDAHO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., June 30, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at Moscow, Idaho, in accordance with drawings and specifications, copies of which may be had from the custodian of site at Moscow, Idaho, or at the Supervising Architect's office.

GIRLS' HOME, RATHBONE, OHIO—Sealed proposals for furnishing the labor and material for the design, construction, delivery and erection of steam and electrical machinery and equipment; changes and additions in steam heating, piping, trenching and conduits; installation of electrical wiring, conduits, teaming and hauling, etc., for the Girls' Industrial Home at Rathbone, Ohio, located in Delaware County, Ohio, addressed to the "Board of Trustees of Girls' Industrial Home," Delaware, Ohio, and indorsed "Proposals for Machinery and Equipment for Girls' Industrial Home," will be received by the said board of trustees until 1 o'clock p. m., July 16, in accordance with the drawings and specifications on file in the office of said board, in the custody of Harold M. Bush, engineer in charge, Broad-Oak Building, Columbus, Ohio.

POST OFFICE AND COURT HOUSE, OWENSBORO, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 27, 1909, and then open, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and a standard clock system) of the United States Post Office and Court House at Owensboro, Ky., in accordance with the drawings and specification, copies of which may be had from the custodian of site at Owensboro, Ky., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE GENERAL ELECTRIC COMPANY has established an office at Indianapolis, Ind., in the Traction Terminal Building, with Percy Worth in charge.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has issued a new line of advertising literature calling attention to its repair department and its special line of bargains.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has ready for the market a number of bargains in motors of various types. Full information and prices are available upon request.

ALFRED F. MOORE, Philadelphia, manufacturer of insulated wire, has arranged to have Frank W. Pardee, 56 Fifth Avenue, Chicago, Ill., take up a sales agency. Mr. Pardee will carry a large stock of Moore's goods.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., has issued the June number of its well-known publication "Juice," which contains some remarks on the National Electric Light Association's convention at Atlantic City.

THE PHŒNIX IRON WORKS COMPANY, Meadville, Pa., announces that it has taken offices in the Trinity Building, New York city, and the Lafayette Building, Philadelphia, Pa., Charles H. Bradley, Jr., and Albert C. Case, district sales managers.

THE PACIFIC ELECTRIC HEATING COMPANY, of Ontario, Cal., and Chicago, Ill., has issued the May number of "Hot Points," a monthly publication boosting the electric iron made by that company. This number contains a poem entitled "The Hot Point."

THE SACHS COMPANY, Hartford, Conn., announces that on June 11, 1909, Judge Brown, in the United States Circuit Court for the District of Massachusetts, dismissed the bill of complaint in the suit brought against the Sachs Company for alleged infringement of Thalacker patent No. 502,541.

THE INTERNATIONAL ACHESON GRAPHITE COMPANY, of Niagara Falls, N. Y., has commenced an action in the United States Circuit Court for the Western District of New York against the Castner Electrolytic Alkali Company, of the same city, alleging infringement of patents relative to its methods of making graphitized electrodes.

THE PITTSBURG TRANSFORMER COMPANY, Pittsburg, Pa., has issued Bulletin 1092 (June, 1909), describing and illustrating the new Pittsburg transformer, in which several substantial improvements have been made for which many advantages are claimed. Thousands of these transformers have been placed in service during the past year.

THE BALL AND WOOD COMPANY, Elizabethport, N. Y., has published a handsome illustrated catalogue describing the Rateau-Smoot exhaust-steam turbine and the Smoot electric generators of either direct or alternating-current types. A claim of from fifty to 100 per cent increase in output, or 150 per cent or more in special cases, is made for these units.

THE HOBSON ELECTRIC COMPANY, Dallas, Tex., has issued folders describing and illustrating Hobson tungsten fixtures, and the Badger portable lamp, which enables an electric light to be placed in any position with the light directed in any direction. "Condulet Talk" No. 110 describes the Crouse-Hinds condulets, which are approved by the underwriters.

THE CRESCENT COMPANY, Chicago, Ill., has issued Catalogue No. 10 describing the various specialties manufactured by the company, which include various forms of lamp guards, soldering tools and materials, cluster and shade combinations, etc. A leaflet of confidential discounts to the trade, and dated June 1, 1909, has been prepared. This cancels all previous prices.

THE DI-EL-ITE MANUFACTURING COMPANY, Philadelphia, Pa., has issued its June, 1909, catalogue and price list, describing the Di-el-ite resistance units manufactured under the patents of Charles Wirt, who is the president of the company. "Di-el-ite" is the insulation used in these resistance units. It is an artificial insulating stone, composed principally of silex or quartz, peculiarly well adapted for electrical work. After being molded into the form desired and properly hardened it has good mechanical strength, and will stand a temperature of 800 degrees Fahrenheit without injury. In addition, its insulating qualities

are so good that fixture joints, for example, with only one-sixteenth of an inch "Di-el-ite" insulation are regularly tested with 4,000 volts alternating current.

THE GENERAL ELECTRIC COMPANY has recently distributed booklet No. 3779, containing a list of this company's snap switches. It will be of decided interest to the general trade.

THE BRUCE-MACBETH ENGINE COMPANY is the name of the new firm formed by the consolidation, effected June 1 last, of the Macbeth Iron Company and the Bruce-Meriam-Abbott Company, both of Cleveland, Ohio. The officers of the new company are: W. C. Bruce, president; C. W. Kelly, vice-president; C. J. Snow, secretary and treasurer, and C. E. Curtiss, manager.

THE EXCELLO ARC LAMP COMPANY, New York, N. Y., has issued Bulletin 102 on its new Duplex arc lamp. This is a double trim lamp, burning thirty hours per trim, and has been favorably received in England and Germany. The Excello Arc Lamp Company is prepared to fill orders for this lamp, which has already attracted a great deal of attention among the American engineers.

THE NERNST LAMP COMPANY'S little monthly, *The Glower*, for June, contains the second of the talks by A. L. Eustice on modern illumination practice. In this installment is taken up a discussion of test methods to be employed in the determination of mean illumination. These talks are thoroughly practical and are based on the results of extended experience in the testing of lighting units and complete installations under both laboratory and commercial conditions.

THE WESTERN ELECTRIC COMPANY, of Chicago, Ill., has opened new offices in Nashville, Tenn. H. W. Hall, direct from the Chicago offices, is in charge. The company will continue sending men into the Nashville section from the Cincinnati branch, but all business from that center will be handled by Mr. Hall. One of the company's largest customers in the United States is the Cumberland Telephone and Telegraph Company, and Mr. Hall will also take care of this company's needs.

THE HOLOPHANE COMPANY, New York city, has issued the May number of "Holophane Illumination," on the front cover of which is a striking picture of the booth in which Holophane glassware is demonstrated at the Rochester Railway and Light Company's salesroom, at Rochester, N. Y., at which the daily sales of gas and electric appliances average over $1,000. This number contains a most instructive article on "Spacing Outlets and Selected Reflectors for General Illumination."

THE FEDERAL SIGN SYSTEM has opened up a branch office at 1230-1231 Syndicate Trust Building, St. Louis, Mo. This makes eight offices in all which this company now maintains—one in each of the following cities: New York, Cincinnati, Kansas City, Philadelphia, Louisville, New Orleans, St. Louis and Chicago. In each of these cities the Federal Sign System (Electric) has developed a considerable sign-renting business, as well as a large sales business of electrical fixtures of all kinds.

THE ROYAL WEAVING COMPANY, Pawtucket, R. I., is about to build a power plant. The plans and specifications, prepared by Charles T. Main, mill engineer and architect, of Boston, Mass., call for a power house ninety-eight by sixty-four feet, with basement, and boiler house ninety-three by forty-seven feet. The generator equipment is to consist of three 500-kilowatt Allis-Chalmers turbine units. In the boiler house will be installed four 350-horsepower Babcock and Wilcox boilers. The building is to be of brick with reinforced concrete roof over the boiler house. The stack will be of red brick, 175 feet high with eight-foot flue.

DATES AHEAD.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

International Municipal Electricians' Association. Convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) June 15, 1909.

924,628. SYSTEM OF ELECTRICAL DISTRIBUTION. Rudolf Braun, Manchester, England, assignor to Westinghouse Electric and Manufacturing Company. Filed October 3, 1906. A load equalizer for an alternating-current circuit comprises a rotary converter having its alternating-current end connected to the circuit and electrically coupled to a direct-current dynamo-electric machine having a flywheel, and means are provided for automatically varying the field strength of one or both machines as the load on the main circuit varies.

924,666. SYSTEM OF CONTROL. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 3, 1906. An automatically operated relay and interlocking switches cause the main switches to operate successively in either forward or reverse order.

924,667. CONTROL SYSTEM FOR ELECTRIC MOTORS. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 3, 1906. A generator and a motor with resistance-varying devices for the circuits of their field-magnet windings have their armatures electrically connected, and means are provided for preventing movement of the device in the motor field circuit from its initial position until the device in the field circuit of the generator has been operated to its extreme position.

924,670. SIGNAL SYSTEM. William H. Kirnan, Bayonne, N. J. Filed February 10, 1909. A master controller actuated by each of several street circuit relays controls the circuit through the windings of the local circuit controller which is actuated by a corresponding street circuit relay to disconnect the contacts of other street circuit relays from the circuit.

924,712. POLE-CHANGER. Noah L. Wine, Polo, Ill. Filed July 10, 1907. A constantly rotating cylinder of insulating material has a pair of spaced commutation rings extending continuously around it, and a pair of commutation segments extending partially around it in the same plane, and leaving portions of the insulated cylinder between the adjacent ends thereof, each of the segments having connection through the cylinder each with respective ones of the rings, and brushes are mounted to contact upon the surface of the rings.

924,714. TELEPHONE SYSTEM. Ernest E. Yaxley, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company. Filed January 18, 1909. The telephone receiver at a telephone station includes a magnetizable core and has two circuits in parallel relation with each other and in serial relation with the line and both adapted to be traversed by current from a source of direct current. Each of these circuits includes a winding serving to magnetize the magnet core, due to the passage of the direct current, one of the windings possessing impedance to obstruct the flow of voice currents and the other of the windings being adapted to permit the passage of voice currents.

924,716. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES OR MOTORS. Carl E. K. Zachau, Muskegon, Mich. Filed January 10, 1907. Includes a bracket provided with a cam surface, a brush-holding frame, a link pivotally secured to the bracket and the frame, and elastic means adapted to hold the frame normally in engagement with the cam surface on the bracket.

924,725. SINGLE-PHASE MOTOR. Sven R. Bergman, Lynn, Mass., assignor to General Electric Company. Filed June 5, 1908. A primary member formed with uniform open slots has a low-resistance main winding distributed in and filling certain of the slots, and a high-resistance starting winding is located in the tops of the remaining slots.

924,735. AUTOMATIC ELECTRIC INTERLOCK SYSTEM. John F. Clark, Christopher, Ill. Filed July 27, 1907. Switch mechanisms are automatically and electrically operated by an approaching train to operate switches for side tracks.

924,746. SIGHTING APPARATUS FOR ORDNANCE. Arthur T. Dawson and George T. Buckham, Westminster, London, England, assignors to Vickers Sons & Maxim, Limited, Westminster, England. Filed November 20, 1908. A differential movement is imparted to an electrically actuated pointer moving over a hand-actuated range dial during the actuation of the range dial, and a cam elevates the sight simultaneously with the operation of the range dial.

924,782. FLEXIBLE CONDUIT. Oscar Hoppe, Brookline, Mass., assignor to American Circular Loom Company. Filed June 15, 1908. A tube formed of a strip of resilient material spirally wound and having its edges in alinement constitutes the framework of a conduit, a seamless non-resilient tube of textile fabric closely fits the interior and forms the lining for the spiral tube, an outer tube of textile fabric sur-

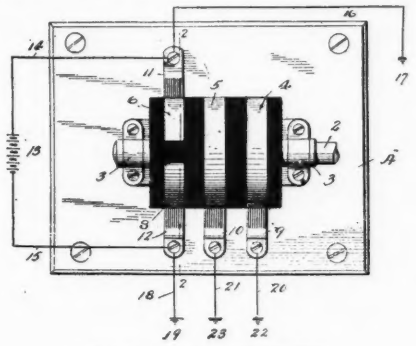
rounds the spiral tube, and all the tubes are saturated with an adhesive compound and thereby cemented together.

924,783. ELECTRIC-LIGHT-BUTTON-TURNING DEVICE. Abraham R. Hurst, St. Louis, Mo. Filed August 8, 1908. A two-part ring adapted to be clamped on the socket of an incandescent electric lamp carries an arm having a bearing ring fixed to it which journals a ratchet wheel having a slot which receives the button of the lamp switch, and a spring-held pawl carried by a spring-held arm engages the teeth of the ratchet wheel.

924,784. TROLLEY-POLE GUIDING AND FINDING DEVICE. James J. Jagolin, Paterson, N. J. Filed March 7, 1908. Has mechanism for guiding the wire-contact portion of the pole into operative relation to the wire and for retaining the pole in operative contact with the wire.

924,785. SYSTEM OF ELECTRIC-MOTOR CONTROL. Henry D. James and William A. Dick, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed October 18, 1907. In combination with a motor are a generator electrically connected thereto, a field rheostat for the generator, independently operated switches for controlling the resistance, and means dependent on the generator voltage for delaying the action of the control switches.

924,786. SYSTEM OF ELECTRIC-MOTOR CONTROL. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. The field of the generator is regulated to control the speed of the motor and the generator field is automatically weakened at predetermined points in the motor operation.



924,712.—POLE CHANGER.

924,799. ELECTRICAL EQUALIZING SYSTEM. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. Several mechanically coupled dynamo-electric machines have their armatures associated, respectively, with different pairs of conductors of a polyphase alternating-current distributing circuit, a polyphase transformer from which the field-magnet-windings of the machines are supplied is connected with the distributing circuit, and means are provided for adjusting the field strengths of the machines to cause them to operate as motors or generators according as the current required of the distributing circuit is less or greater than a predetermined amount.

924,800. ELECTRIC SIGNAL MECHANISM FOR OVERHEAD-TROLLEY SYSTEMS. Harold A. Lines, West Haven, Conn. Filed December 23, 1908. A lever is actuated by a passing trolley wheel to make electric connections with signal lights whereby the lights may be turned on or off.

924,804. ELECTRIC SLIDING OR OTHER CONTACT. Victor Löwendahl, Stockholm, Sweden, assignor to the Firm of C. Conrady, Nuremberg, Germany. Filed March 16, 1908. A metallic part and a part formed by a pulverous mixture of carbon and metal or alloy are soldered together, whereby the parts are strongly and durably connected and constitute one coherent body.

924,826. BATTERY CONNECTION. Oliver E. Pettee, Rockland, Me. Filed October 14, 1908. A doubled strip of metal is formed with a pin, a pocket and a pair of clamping jaws.

924,827. OSCILLATION-RECEIVER. Greenleaf W. Pickard, Amesbury, Mass. Filed September 16, 1907. Comprises two electrical conductors which respectively possess rectifying properties, the action of one conductor being to oppose oscillation passing from it toward the other, and the action of the other conductor being to oppose oscillations passing to it from the other.

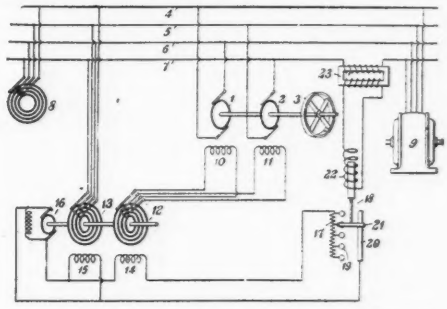
924,829. THIRD-RAIL CONTACT-SHOE. Robert R. Potter, Weehawken Heights, N. J. Filed January 12, 1909. A hook engages the carrier and a retaining spring bears upon the carrier and upon the shoe for holding the several parts in their proper relative positions.

924,830. SWITCH-THROWER FOR ELECTRIC RAILWAYS. Thomas C. Reynolds, Texarkana, Ark. Filed March 24, 1909. A plug adapted to shift a switch is moved by a passing car.

924,844. FUSE-BOX. Harry W. Sheehy, Akron, Ohio. Filed May 5, 1908. Comprises a casing, a reversible cover for the casing, a fuse wire upon each side of the cover, and means for introducing either of the fuse wires into the circuit.

924,851. COIN-CONTROLLED DEVICE. Walter H. Steiger, Elmira, N. Y., assignor to Union Shoe Polishing Machine Company, Elmira, N. Y. Filed May 18, 1908. In combination with a coin-operated serving mechanism are a source of electrical energy, actuating elements operatively connected therewith, a coin passage so disposed with reference to the actuating elements that a coin engages therewith successively, means for pressing the coin against the actuating elements, and operative connection between this means and the serving mechanism.

924,857. CONSTANT-CURRENT REGULATOR. Allen A. Tirrill, Schenectady, N. Y., assignor to General Electric Company. Filed November 4, 1907. In a dynamo-electric machine with differential windings in its field are a resister included in the circuit of one of these windings, and means for rapidly opening and closing a shunt around the resister and for controlling the relative length of the interval during which the shunt is closed.



924,927.—ELECTRICAL EQUALIZING SYSTEM.

924,860. RENEWABLE FUSE FOR ELECTRIC CIRCUITS. Joseph A. Volk, Jr., South Norwalk, Conn. Filed March 25, 1908. Has a low-melting fuse passing diagonally through the tube and through channels in the end plugs.

924,863. SPARK-IGNITION DEVICE FOR EXPLOSIVE-ENGINES. James A. Whitton, Los Angeles, Cal., assignor of one-half to John W. Miller, Los Angeles, Cal. Filed November 26, 1907. A revolving circuit maker and breaker is provided with a radially adjustable contact revoluble in a raceway adjacent to which are a number of stationary insulated grounding contacts.

924,868. ELECTRIC-WELDING MACHINE. William C. Winfield and Albertis C. Taylor, Warren, Ohio, assignors to the Winfield Manufacturing Company. Filed February 17, 1908. The work is clamped between jaws operated by toggle joints.

924,910. SAFETY DEVICE FOR RAILROADS. John W. Ledwon, South River, N. J. Filed October 27, 1908. Describes an electric block system.

924,916. ARC LAMP. Berthold Monasch, Berlin, Germany, assignor to General Electric Company. Filed July 9, 1908. One at least of a pair of electrodes is fed forward as it consumes, and a magnet traveling with the electrode toward the arc extinguishes the arc when it has reached a predetermined proximity to the same.

924,927. ELECTRICAL EQUALIZING SYSTEM. John S. Peck, Manchester, England, assignor to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. In combination with a number of mechanically coupled dynamo-electric machines having their respective armatures associated with the differently phased electromotive-forces of a polyphase alternating-current distributing circuit, are means for adjusting the field strengths of the machines in accordance with variations in the amount of current required of the distributing circuit.

924,940. AUTOMATIC WEIGHING MEANS. Wilbur H. Rough, Arlington, Cal. Filed October 1, 1908. A weighing machine comprises a row of bins, a gate for each bin, an armature controlling the movement of the gate to a closed position, a weighing scale movable to position to receive material from any one of the bins, a circuit controlled by this scale, and an electromagnet connected by this circuit and movable

with the scale to operate on the armature for the bin at which the scale is placed.

924,952. SNAP-SWITCH. James H. Wyatt, Philadelphia, Pa., assignor to William M. Scott, Philadelphia, Pa. Filed April 28, 1908. Has a pivoted contact-carrying member, a detent engaging and rotating with this, a coiled spring engaging ears on the detent to hold the detent in normal position, an operating spring, a spring-winding member, and a projection on the winding member to engage the ears at the end of the movement of the winding member.

924,954. AUTOMATIC GAS SHUT-OFF. William E. Apt and Edmund L. Schott, St. Joseph, Mo. Filed January 28, 1909. A circuit-breaker between the two arms of a combined spring lever is automatically closed when one of these arms is engaged by a combined armature and trigger lever and automatically broken when the combined armature and trigger lever releases the spring lever.

924,964. VALVE AND CONNECTION. George P. Carroll, Bridgeport, Conn. Original application filed March 1, 1907. Divided and this application filed June 5, 1907. Automatic means are electrically actuated so as to shut off the power applied to open a valve.

924,968. ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS. Charles Crandall, Newport, R. I. Filed July 2, 1908. Describes the details of an electric block-signaling system.

924,975. VAPOR ELECTRIC LAMP. Samuel Ferguson, Schenectady, N. Y., assignor to General Electric Company. Filed June 29, 1904. The device described comprises a solenoid, a vapor-electric device having a contact-making cap, and a spring contact in the interior of the solenoid for engaging with the cap.

924,977. ELECTRICAL APPARATUS. William J. Foster, Schenectady, N. Y., assignor to General Electric Company. Filed February 1, 1906. A field pole of a dynamo-electric machine has an insulating collar at one end of its surrounding coil, and a short-circuiting electrical conductor surrounding the pole and in engagement with the collar, which conductor has ribs or lugs outlining pockets to diminish the transfer of heat from the conductor to the insulating collar.

924,989. MERCURY-METER. Frank Holden, London, England, assignor to General Electric Company. Filed March 19, 1907. The paddle wheel has a number of sets of radial paddles separated by partitions at right angles to the axis of the wheel.

924,991. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE. Dugald C. Jackson, Madison, Wis. Filed February 23, 1904. Has an auto-transformer connected in series with the field magnet to a source of alternating-current, an armature having a commutated winding and a closed circuited winding associated with the field magnet, a commutator connected by suitable leads with the commutated winding, a set of brushes bearing on the commutator and deriving current from the auto-transformer, a secondary set of brushes bearing on the commutator, a local circuit connecting the brushes of the secondary set, and resistances partially short-circuiting the commutated windings.

924,992. DYNAMO-ELECTRIC MACHINE. Dugald C. Jackson, Madison, Wis. Original application filed January 11, 1904. Divided and this application filed October 23, 1905. The armature has a commutated winding, a resistance is included serially in each of the conductors connecting the armature winding with the commutator, and inductive coils are bridged between adjacent conductors at a point between the other resistances and the armature winding.

925,004. SLACK TAKE-UP FOR PENDANT ELECTRIC LIGHTS. John Maitland, Swampscott, Mass. Filed March 29, 1909. Gripping members are mounted on and laterally extended from the opposite ends of the carrier.

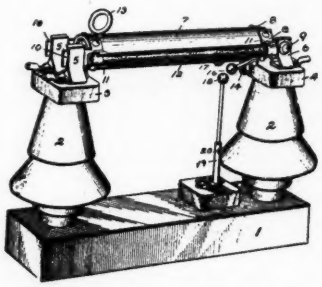
925,010. BRUSH-HOLDER. Edgar W. Mix, Paris, France, assignor to General Electric Company. Filed August 17, 1904. Comprises a pair of plates separated from each other by a space in which a number of brushes are slidingly received, a rail or bar carried by one of these plates, and a spring for each brush, one portion of which engages the brush, and another portion the bar or rail.

925,026. BLOCK-SIGNAL SYSTEM. Frank Rhea, Schenectady, N. Y., assignor to General Electric Company. Filed April 6, 1909. Describes the details of an electric block-signal system.

925,050. ELECTRIC HEATING DEVICE. Walter Sprenger, Lynn, Mass., assignor to General Electric Company. Filed March 30, 1908. A supporting stand for an electrically heated tool has connections whereby the current is cut off from the tool and automatically applied to the stand when the tool is placed upon the stand.

925,053. WATER-SWITCH. William B. Sturgis, Shelbyville, Ill. Filed May 22, 1908. An electrical circuit is closed by the rise of a float and opened by the fall thereof.

925,054. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS. John B. Taylor and Daniel S. Carpenter, Schenectady, N. Y., assignors to General Electric Company. Filed March 15, 1907. A switch has a movable blade for each side of a circuit and a line discharge terminal mounted on each blade, and a grounded discharge terminal co-operates with both of the line terminals when the switch is closed.



925,054.—PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

925,055. MEASURING INSTRUMENT. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. Filed May 11, 1908. An electrical measuring instrument comprises a current-carrying conductor, an elastic medium responsive to changes of temperature of this conductor, and means for indicating the changed vibration rates under such changes of temperature.

925,056. ELECTRIC SOLDERING IRON. Tycho Van Aller, Schenectady, N. Y., assignor to General Electric Company. Filed March 25, 1908. Has a flat electric heating unit, a soldering tip having one end in heat-conductive relation with this unit throughout its area, and means for holding these parts together.

925,060. VAPOR-ELECTRIC APPARATUS. Ezechiel Weintraub, Schenectady, N. Y., assignor to General Electric Company. Filed December 21, 1903. Renewed November 21, 1906. A vapor-electric lamp has a vaporizable cathode and a receiving circuit for electromagnetic waves which control the means for starting the lamp.

925,064. ELECTRIC METER. Willis R. Whitney, Schenectady, N. Y., assignor to General Electric Company. Filed March 16, 1907. The method of measuring electric current consists in causing ions to migrate through an electrolyte at a rate proportional to the current and to react with the electrolyte to produce permanent changes in color and thereby show the rate of migration.

925,069. RHEOSTAT. Paul H. Zimmer, Schenectady, N. Y., assignor to General Electric Company. Filed April 6, 1908. The controlling arm has a bias to its initial position and means controlled by a low-voltage magnet hold a member having a frictional engagement with the arm and normally movable therewith, as the arm slips over the same to vary the resistance.

925,081. ELECTRIC EXPANSION-VALVE. George P. Carroll, Bridgeport, Conn. Filed March 1, 1907. A magnetizable device movable through a segment of a circle operates only when magnetized to open the valve, and means controlled by electric power are provided for automatically shutting off the current that magnetizes and so moves the device.

925,084. ELECTRIC-LAMP CLEANER. Edward E. Edgerton, Chicago, Ill. Filed January 16, 1909. A long handle has at one end movable jaws which embrace the lamp bulb.

925,086. ELECTRIC-LAMP-SHADE SUPPORT. Roger S. Furniss, Chicago, Ill. Filed December 18, 1908. A clamp comprises a stationary and a movable jaw, the movable jaw being slidably mounted on a guide on the stationary jaw, and a lamp shade is mounted on the outer end of a rod slidably mounted in a sleeve fixed to the stationary jaw and extending through the movable jaw.

925,093. SUPPLY SYSTEM FOR TELEPHONE-CIRCUITS. John L. Hall, Schenectady, N. Y., assignor to General Electric Company. Filed June 8, 1906. The telephones are connected to the load circuit, which is connected across certain of the armature conductors of a dynamo-electric machine having a uniform homopolar field magnet.

925,094. TROLLEY HARP AND WHEEL. Frank E. Hancock, Sherman, Cal., assignor to Eureka Trolley Harp Company. Filed April 20, 1908. Has an anti-displacement element comprising a head provided with side arms loosely connected

with an arbor movable in the elongated slots of the side plates of the harp.

925,098. LOCK-OUT DEVICE FOR COMMON-BATTERY TELEPHONES. Ralph D. Harris, John E. Johnson and Henry W. Soest, Fort Wayne, Ind. Filed June 1, 1908. A locking device for the receiver hook is electromagnetically released.

925,102. ELECTRICAL DISTRIBUTION SYSTEM. Henry M. Hobart, London, England, and Evelyn Coad, Bremen, Germany. Filed January 4, 1909. Connections are made between an auto-transformer having tappings and the secondary of a transformer having a divided secondary, by which a section of the one is put in series with a section of the other.

925,108. MOTOR-CONTROLLING DEVICE. Richard M. Klein and David R. Sperry, Madison, Wis., assignors to Northern Electrical Manufacturing Company. Filed March 23, 1908. Means are provided for automatically varying the motor of a motor-driven machine from one operating speed to another and back again during a predetermined movement of the machine.

925,110. CAR-LIGHTING SYSTEM. Sigvald Krohn, Charlottenburg, Germany, assignor to General Electric Company. Filed February 28, 1907. A lighting system for electric cars comprises a number of sets of lamps, a source of current varying in potential, and means for automatically changing the relative arrangement of the sets of lamps in the circuit as the potential at the source of current varies.

925,113. ELECTRICAL MEASURING INSTRUMENT. William J. Lloyd, Rugby, England, and Leonard Wilson, Denver, Colo., assignors to General Electric Company. Filed May 21, 1907. The instrument has means for producing two magnetic fields, a conductor is arranged for movement in one of the fields, and a device for furnishing a counter-torque to the moving conductor comprises a spring and an unsaturated magnetic control piece moving with the conductor in the other magnetic field.

925,123. SIGNAL MECHANISM. William V. Moak, Schenectady, N. Y., assignor to General Electric Company. Filed November 18, 1908. Connections are provided whereby the unidirectional rotation of a rotary motor produces a reciprocating movement of a member which serves as common driving member for both of a pair of independently movable signal-actuating members.

925,125. ELECTRIC METER. Peter C. Morganthaler, Fort Wayne, Ind., assignor to General Electric Company. Filed January 17, 1908. The meter has a shaft which has a lower thrust bearing, and a collar at each end of the shaft. A lever in operative relation with one collar lifts the shaft away from the bearing and holds one end firmly, and a cap for the bearing encircles the shaft and is in operative relation with the other collar, holding the same firmly when the shaft is lifted.

925,132. DYNAMO-ELECTRIC MACHINE. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Company. Filed February 29, 1908. Has a rotatable member mounted on a shaft arranged to be movable axially in its bearings, a breakable spindle between the shaft and a driven device, and means for preventing the shaft from moving axially under normal conditions.

925,137. AUTOMATIC BRAKE SYSTEM. William U. G. Shaw and Oscar Johnson, Lafayette, Ind., assignors of one-third to Valentine McNeer, Wabash, Ind. Filed January 22, 1908. Describes an automatic brake system for an electric car.

925,155. ELECTRIC FLUID HEATER. Cummings C. Chesney, Pittsfield, Mass., and Howard B. Wilson, Schenectady, N. Y., assignors to General Electric Company. Filed March 12, 1908. Pipe connections are provided for maintaining a circulation between a fluid-containing tank and an electric heater.

925,160. ELECTROMAGNETICALLY - CONTROLLED SWITCH. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. Filed March 30, 1908. A movable element is magnetically controlled by an actuating coil which has a second coil located in inductive relation to it, and electromagnetically-controlled means receive current from the second-mentioned coil for retarding the operation of the switch in response to the energization of the actuating coil.

925,165. CONDENSER. Augustine R. Everest, Lynn, Mass., assignor to General Electric Company. Filed August 7, 1905. Has a box-like frame comprising end members and bars connecting these end members, supporting pins carried by the bars, plates of conducting materials supported by the pins, and barriers of insulating material supported between adjacent pins.

925,166. ARC LAMP. Walter C. Fish and Richard Fleming, Lynn, Mass., assignors to General Electric Company. Filed May 29, 1903. A double-wall reflector encloses an outwardly-extending chimney space open at the center for the reception of the products of combustion and open at the periphery for the discharge of those products.

925,168. FASTENING FOR ELECTRICAL SIGN RECEPTACLES. Edgar H. Freeman, Trenton, N. J. Filed February 4, 1909. Describes the details of an electrical receptacle mounting.

925,171. CIGAR LIGHTER. Augustus C. Gruhlke, Waterloo, Ind. Filed April 23, 1908. Has an electric sparking coil and sparking terminals.

925,179. TELPHER SYSTEM. Barnett W. Harris, Buffalo, N. Y., assignor to American Telpher Company. Filed June 18, 1908. The endless track forms a stationary electric conductor and the cars are connected by a movable conductor.

925,180. METHOD OF AND APPARATUS FOR MEASURING POWER. Jesse Harris, West Lafayette, Ind., assignor of one-half to Charles B. Moore, West Lafayette, Ind. Filed April 16, 1908. The resultant of opposing electromotive-forces, the extent of whose opposition is governed by the relative movement between driving and driven elements united by a resilient coupling, operates the power-reading instrument.

925,185. ELECTRICITY METER. Sydney H. Holden, Birmingham, England. Filed July 18, 1908. Describes a form of continuous-current watt-hour meter.

925,187. ELECTRICITY METER. George Hookham, Birmingham, England. Filed July 18, 1908. Describes a form of motor meter.

925,225. SWITCH. Loulie Quattlebaum, Decatur, Miss. Filed October 29, 1908. A knife switch has a blade with a pivoted and sliding connection with a central terminal post to permit its engagement with either or both of two end terminal posts.

925,239. SPARK PLUG. Fred W. Smith, Aberdeen, S. D. Filed June 22, 1908. Describes the details of a form of spark plug.

925,254. DYNAMO-ELECTRIC MACHINE. John B. Wiard, Lynn, Mass., assignor to General Electric Company. Filed April 29, 1907. Has a distributed winding, and a separate connection ring or cable comprising a support in the form of flat parallel annular strips and circumferentially-extending conductors bound between these strips with ends projecting through holes in one of the strips and establishing predetermined connections between the coils of the winding.

925,260. SIGNALING DEVICE FOR GRAVES. Carl R. Zimmermann and Victor G. Gustafson, Joliet, Ill. Filed May 9, 1908. The casket has a ventilator connected with an air pipe, also electric signaling means connected to a bell outside.

925,270. ELECTRIC GEAR-CHANGING MECHANISM FOR AUTOMOBILES. Frank Beemer, Philadelphia, Pa., assignor to Samuel S. Eveland, Philadelphia, Pa. Filed August 5, 1907. Gear shifters are electromagnetically actuated or locked.

925,271. CORE-SPACING MEMBER FOR DYNAMO-ELECTRIC MACHINES. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed August 31, 1906. Each spacing member comprises a pair of toothed plates abutting against the end laminas of adjacent core sections, each plate having projections bearing on the other plate and staggered so that the projections of one plate do not interfere with those of the other plate.

925,272. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed May 27, 1907. The pedestals are hollow so as to serve as conduits through which air is admitted into the housings for the end bearings.

925,291. RECEIVER FOR WIRELESS SIGNALING. Hugh C. Cayley, Riverside, Cal. Filed April 21, 1908. A wave detector has an imperfect contact comprising two members, one of which is movable relatively to the other, an armature lever (controlled by a magnet) connected with the movable member, a battery circuit connected with the imperfect contact and with the magnet, and a shunt circuit connected with the battery circuit and including a condenser and telephonic receiver.

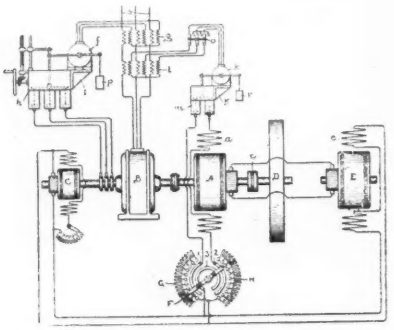
925,293. CABLE CONNECTOR. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 30, 1906. Consists of a pair of interfitting metallic terminal members, and one or more dowel pins and a spring-clamping sleeve fixed relatively to one of the members, for holding the terminal members together.

925,300. BATTERY-FILLING MACHINE. Clyde J. Coleman, New York, N. Y., assignor to Conrad Hubert, New York, N. Y.

Filed March 29, 1907. Comprises a chute to direct the filling material into a cell, a screw-formed packing device located in the chute, and mechanism operating automatically to position an empty cell and hold it stationary beneath the chute.

925,312. CENTRIPETAL ELECTRIC SWITCH. Taylor J. Downer, Colorado Springs, Colo. Filed April 13, 1908. Describes a form of circuit closer actuated by the centrifugal force from a revolving shaft.

925,322. RAILWAY SIGNAL AND TRAIN-CONTROLLING MECHANISM. Ellsworth E. Flora and Robert J. Zorge, Chicago, Ill., assignors to Zorge Safety Railway Equipment Company. Filed May 13, 1908. Local train-controlling means are located between the points to be protected and a torpedo-



925,385.—SYSTEM OF TRANSMISSION.

placing mechanism located in advance of that point, which means comprises a movable stop arm, mechanical actuating means therefor and circuit-interrupting means for the circuit connected with the mechanical actuating means.

925,341. RHEOSTAT AND CONTROLLING DEVICE. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed October 3, 1906. Divided and this application filed March 31, 1909. In combination with the supply circuit and two resistances connected in parallel with it, are a distributing circuit the terminals of which are connected to the respective resistances, and movable shunts for portions of the resistances each of which extends only between points of the same resistance.

925,343. SWITCH FOR RAILWAYS. Frank H. Kaiser, Buffalo, N. Y. Filed October 2, 1907. A reversible motor gears yieldingly with a switch point.

925,345. SWITCH AND DETECTOR-BAR-THROWING MECHANISM. Charles R. Keeran, Bloomington, Ill. Filed February 19, 1908. An electrically-actuated clutch connects a reversible motor with the gearing for connecting a rotary element to a switch-throwing element.

925,353. ELECTRIC SIGNALING SYSTEM FOR RAILWAYS. Fred Lacroix, San Antonio, Tex., assignor to Electrical Automatic Railroad Safety Signal Company. Filed January 24, 1907. Renewed November 6, 1908. Describes a form of electric block-signal system.

925,355. METHOD OF AND MEANS FOR OPERATING DYNAMO-ELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed August 2, 1906. A series motor has means for connecting its field-magnet windings to a distributing circuit, and only the armature windings in closed circuit with a resistance, for operating the motor as a generator.

925,356. ELECTRICAL LOAD-EQUALIZING SYSTEM. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed September 3, 1907. Divided and this application filed November 6, 1908. Includes a transformer connected to an alternating-current distributing circuit, a dynamo-electric machine connected to the transformer, and means for applying to the field-magnet winding of the machine an electromotive-force different in phase from that of the circuit, also means for adjusting the ratio of transformation of the transformer in accordance with variations in the amount of current required of the distributing circuit.

925,357. ELECTRICAL EQUALIZER SYSTEM. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed September 3, 1907. Divided and this application filed November 30, 1908. In combination with a two-phase alternating-current distributing circuit are two mechanically coupled dynamo-electric machines, each having its armature associated with one pair of conductors of a circuit and its field-magnet winding associated with the other pair of conductors, similar windings being associated with different pairs of conductors.

925,385. SYSTEM OF TRANSMISSION. Ernst Riecke, Berlin, Germany, assignor to General Electric Company. Filed March 20, 1908. A generator coupled to a flywheel is driven by an electric motor, and means operated by the flow of current to the motor are provided for decreasing its speed, also means for automatically inserting a resistance into the generator field in order to limit the power input to the motor.

925,392. DYNAMO-ELECTRIC MACHINE. George B. Schley, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 31, 1906. A three-wire dynamo has main and commutating field poles, each of the commutating poles having a number of windings, the strength of the commutating poles varying with the total energy of the dynamo.

925,403. ELECTRICAL INDICATING INSTRUMENT. Hermon L. Van Valkenburg, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed September 29, 1906. Means are provided for moving the scale only after the indicator has moved a predetermined distance.

925,412. ELECTRIC TESTING INSTRUMENT. Herbert G. Addie, Cresco, Iowa, assignor to Arvid L. Peterson, Cresco, Iowa. Filed February 5, 1908. Includes a source of electricity for energizing an alarm mechanism, and an electric lamp connected with the source of electricity, and energized independently of the alarm mechanism.

925,420. MEANS FOR DISCONNECTING TELEPHONE LINES. Moses Bowman, McHenry, Md., assignor of one-half to Chauncey Bowman, Boynton, Pa. Filed July 7, 1908. Describes a device for disconnecting the house and line wires of telephone lines.

925,426. ELEVATOR SAFETY DEVICE. Jacob Cloos, Milwaukee, Wis., assignor to Joseph H. Hirz and Henry H. Schroeder, Milwaukee, Wis. Filed October 12, 1908. A switch in an auxiliary circuit carried by the car is adapted to be operated by the landing doors.

925,441. CIRCUIT-BREAKER. Herbert W. Cheney, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed September 25, 1905. A pivoted lever has mounted on it a bridging contact or brush arranged to engage the flat faces of a pair of stationary contacts.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 21, 1909:

477,206. ELECTRIC ALARM CLOCK. Benjamin Franklin, Chicago, Ill.

477,223. MEANS FOR OPERATING AMMETERS AND OTHER ELECTRICAL APPARATUS. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y.

477,250. DISTRIBUTION OF ROTARY ELECTRIC CURRENTS. Alard E. DuBois-Reymond, Berlin, Germany.

477,247. RHEOSTAT. George K. Cummings, Chicago, Ill.

477,273. ELECTRIC ARC LAMP. Norman F. Rutherford, Bathurst, New South Wales.

477,350. PROCESS OF ELECTROPLATING WITH ALLOYS. Edward T. Burrows, Portland, Me.

477,374. ELECTRICAL SWITCH. Charles J. Klein, New York, N. Y.

477,383 and 477,384. PRINTING TELEGRAPH. Charles J. Reed, Orange, N. J.

477,407. INCANDESCENT ELECTRIC LAMP SOCKET. Jacob S. Gibbs, Hartford, Conn.

477,409. ELECTRIC SWITCH. Edwin T. Greenfield, New York, N. Y.

477,427. ELECTRIC ARC LAMP. Frederic V. Maquaire, Paris, France.

477,579. TEST CIRCUIT FOR MULTIPLE SWITCHBOARDS. Charles E. Scribner, Chicago, Ill.

477,612. ELECTRIC SWITCH. Eugene A. Snow, Syracuse, N. Y.

477,613. COMBINED WEIGHING, LIFTING, MEASURING AND ELECTRIC MACHINE. August Sundh, Yonkers, N. Y.

477,627. ELECTRIC EMBOSSING STAMP. Charles E. Carpenter, Minneapolis, Minn.

477,628. ELECTRIC HEATER. Charles E. Carpenter, Minneapolis, Minn.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

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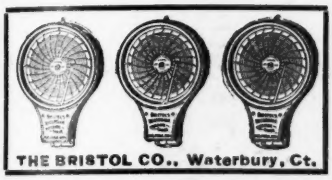
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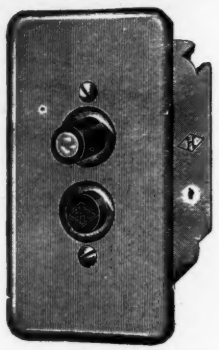

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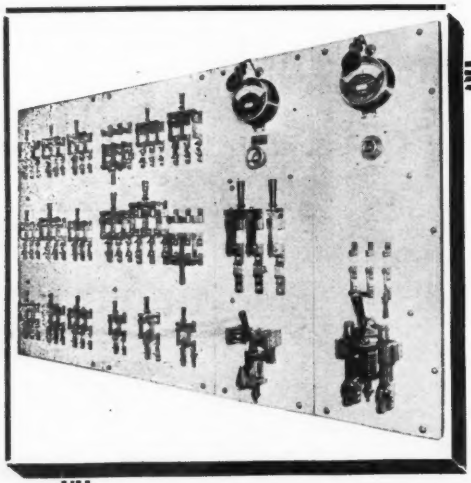

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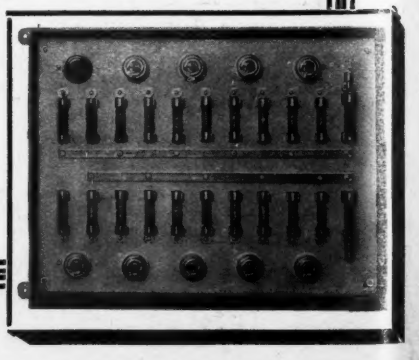

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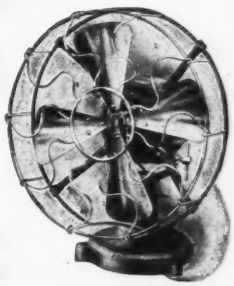

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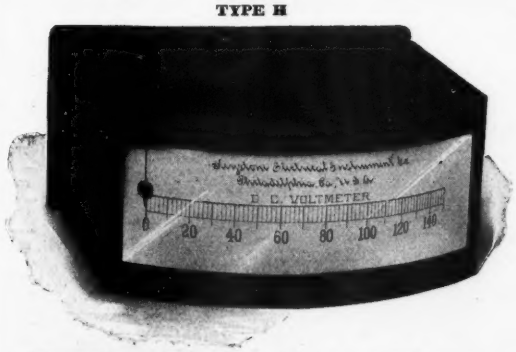

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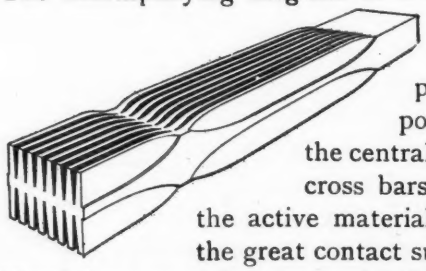

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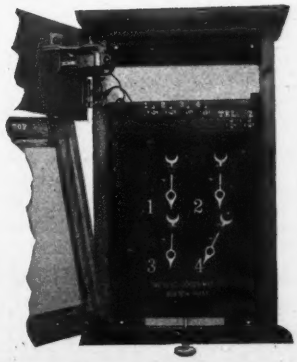

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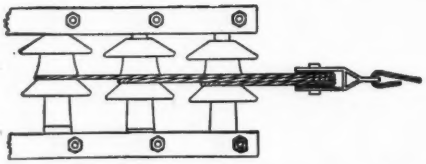

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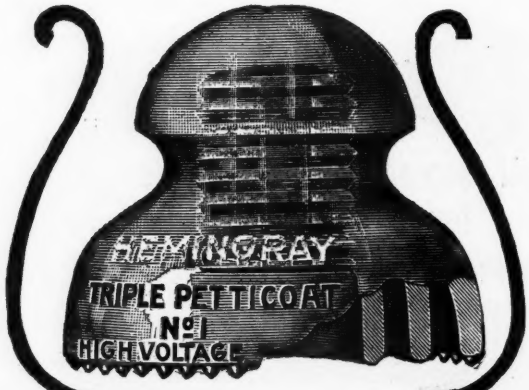

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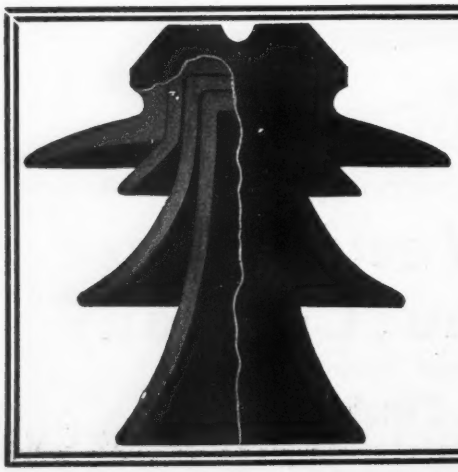

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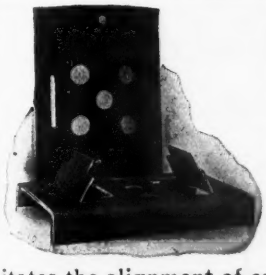

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"ROOKERY"—Chicago—

OKONITE
TRADE MARK
REG. U.S. PATENT OFFICE

THE STANDARD FOR RUBBER INSULATION

THE PLAIN TRUTH

ABOUT

PLAIN INSULATION

The merit of an insulated wire being determined by the quality or character of its insulation, it logically follows that testings for quality should be conducted upon the plain insulation only; that is, before the application of tapes, braids or other protective coverings.

OKONITE
TRADE MARK
REG. U.S. PAT. OFFICE.

THE OKONITE COMPANY, Ltd.

253 BROADWAY
NEW YORK

OKONITE

TRADE MARK
REG. U.S. PATENT OFFICE.

THE STANDARD FOR RUBBER INSULATION

January 1st, 1909

Turn over a new leaf and keep it clean. Make it a record of successful accomplishment free from the blemish of breakdowns or interrupted service.

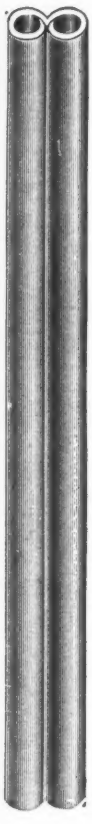
Use **Okonite Insulated Wires** and save yourself money, worry and the petty annoyances incident to the use of cheap and necessarily poor grades of insulated wire.

To one and all

A Happy and Prosperous New Year

THE OKONITE COMPANY, Ltd.

253 BROADWAY
NEW YORK



A BETTER SLEEVE

Than the one you are using at the same price, or better, is your biggest reason for adopting the

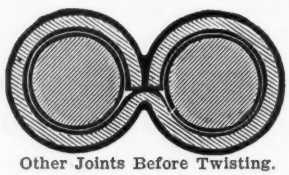
HARVARD

SELF-WELDING WIRE JOINT

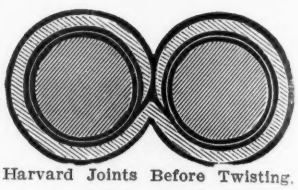
("The Joint with the Beveled Edge")

The paper-thin edge creeps around the inside of the barrel when joint is twisted, thus reducing the bore and forming a perfect covering for the wire throughout its entire length.

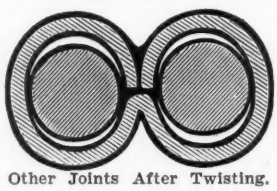
Write for free samples and make your own tests. All sizes carried in stock.



Other Joints Before Twisting.

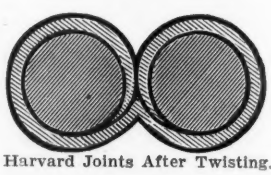


Harvard Joints Before Twisting.



Other Joints After Twisting.

☞The Beveled edge does it. The more you twist the tighter it grips☞



Harvard Joints After Twisting.

HARVARD ELECTRIC COMPANY

65 W. Van Buren St., Chicago — 136 E. Liberty St., New York, N. Y.

Metropolitan Electrical Supply Company

184 Lake Street - CHICAGO

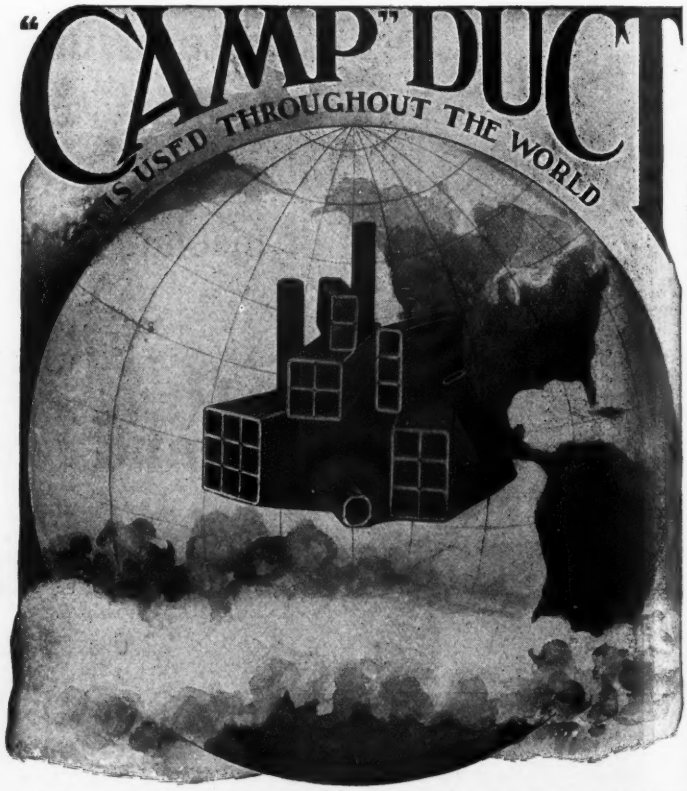
Everything Electrical

AGENTS FOR

Crescent Insulated Wire and Cable Co.
Navalite Rigid Conduit
De Ronde's Insulating Paint and Polish
United States Incandescent Lamps, Etc.

We carry large stocks and make prompt shipments at bottom prices.

"CAMP" DUCT



CAMP" DUCT is known for its permanency through all time. It lasts longer than any other conduit and gives better service.

"CAMP" DUCT MEETS THE MOST RIGID SPECIFICATIONS

THE H. B. CAMP COMPANY

Flatiron Building NEW YORK — Commercial National Bank Building CHICAGO — Fulton Building PITTSBURG

MAKERS OF THE WORLD'S BEST CONDUIT

PARANITE

RUBBER COVERED WIRES AND CABLES

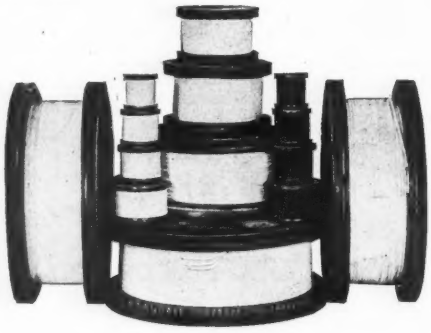
For Aerial, Underground, Submarine and Inside Use. Telephone, Telegraph and Electric Light Wires and Cables

Indiana Rubber and Insulated Wire Co.,

JONESBORO, INDIANA.

MAGNET WIRE

It is as near perfection as modern machinery and careful manipulation can make it.



ROUND, SQUARE AND RECTANGULAR
ASBESTOS, COTTON AND SILK
LARGE STOCK OF STANDARD SIZES
UNUSUAL SIZES SHIPPED PROMPTLY

Everything IN Electrical Conductors

FACTORIES
Perth Amboy, N. J.
Pittsburgh, Pa.
Oakland, Cal.

LAMP CORD

Of the same high quality that distinguishes all our products.

SILK AND COTTON
ALL COLORS

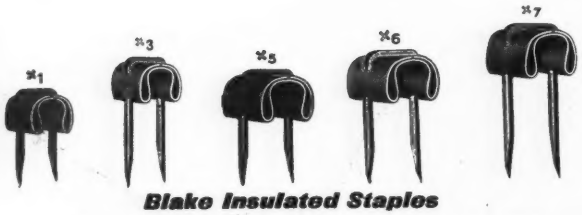
Standard Underground Cable Co.

Pittsburgh, Pa.

BOSTON NEW YORK PHILADELPHIA CHICAGO ST. LOUIS SAN FRANCISCO

BLAKE SPECIALTIES

FOR SALE BY ALL DEALERS



Blake Insulated Staples

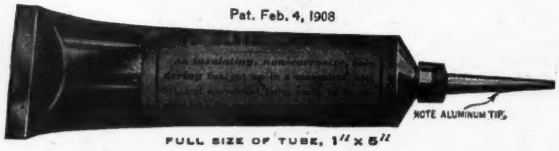
The only mechanically correct method of securing low-voltage wires with a driven fastener.

Blake Compressed Cleats

For use where a screw fastening is desirable WILL HOLD THE SLACK. NO BREAKAGE.

BLAKE TUBE FLUX

Convenient to carry and to use. Will not collect dust and dirt nor get on tools in kit.

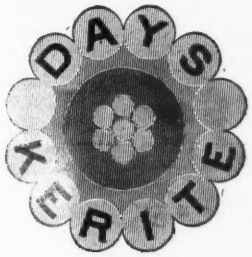


FULL SIZE OF TUBE, 1″ x 5″

You can get the soldering flux just where you want it and in just the desired quantity.

BLAKE SIGNAL & MFG. CO. 246 Summer Street BOSTON, MASS.

KERITE



INSULATED WIRES AND CABLES

INTERIOR AERIAL
UNDERGROUND SUBMARINE

KERITE has back of it an unequaled record of half a century of successful service under the most adverse conditions.

Initial tests determine whether an insulated wire will do the work for which it is intended, BUT initial tests can NOT determine if it will do that work years hence.

KERITE wires and cables installed half a century ago are in service today.

KERITE does not deteriorate but improves with age.

The wonderful durability of KERITE insures the highest efficiency, safety and economy and is a guarantee of the best and most successful results.

The property of KERITE in resisting deteriorating influences and the qualities which render it so indestructible are facts which should be considered where an insulated wire is used.

Take advantage of the experience of others and insure your service with KERITE.

SOLE MANUFACTURER

KERITE INSULATED WIRE & CABLE CO.

INCORPORATED BY

W. R. BRIXEY

General Offices, Hudson Terminal, 30 Church Street, New York

Western Representative, WATSON INSULATED WIRE CO., Railway Exchange, Chicago, Illinois

BARE and INSULATED COPPER WIRE

Lead Incased Cables

Galvanized Telegraph Wire

John A. Roebling's Sons Co., Trenton, N. J.

AGENCIES AND BRANCHES: NEW YORK, CHICAGO, CLEVELAND, ATLANTA, OAKLAND, Cal., LOS ANGELES, PORTLAND, Ore., SEATTLE

The National Conduit and Cable Co.

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Manufacturers of

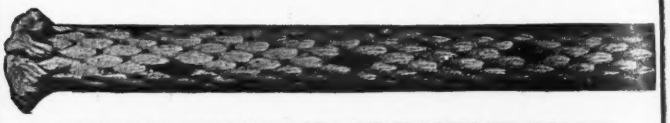
Bare Copper Wire and Cable
Weatherproof Wires and Cables
Paper Insulated Cables
For Power, Telephone and Telegraph

BOSTON PHILADELPHIA CHICAGO
SAN FRANCISCO

HAZARD
INSULATED WIRES AND CABLES

Hazard Manufacturing Company
WILKES-BARRE, PA.

NEW YORK PITTSBURG CHICAGO



SAMSON SPOT WATERPROOFED CORD FOR TROLLEYS AND ARC LAMPS.

Send for Samples. SAMSON CORDAGE WORKS, BOSTON, MASS.

ATLANTIC INSULATED WIRE AND CABLE CO.
WIRES AND CABLES

FOR SUBMARINE, AERIAL, UNDERGROUND AND INTERIOR USE

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ELEPHANT BRAND
DELTA
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THE PHOSPHOR BRONZE SMELTING CO., Limited.
2200 WASHINGTON AVENUE, PHILADELPHIA, PA.
ELEPHANT BRAND Phosphor Bronze
INGOTS, CASTINGS, WIRE, RODS, SHEETS, Etc.
— DELTA METAL —
CASTINGS, STAMPINGS AND FORGINGS
ORIGINAL AND SOLE MAKERS IN THE U. S.

RUBBER-COVERED WIRES AND CABLES
NATIONAL ELECTRIC CODE STANDARD

N. I. R. Wires and Cables carried in stock by the Monarch Electric and Wire Company, Chicago, Ill.

National India Rubber Co.
Factories and General Offices:
BRISTOL, R. I.
Branch Offices:
New York Chicago Boston
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W. R. OSTRANDER & CO.
Manufacturers and Dealers in all kinds of
Electrical Supplies, Bells, Annunciators, Speaking Tubes, Etc.
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NEW ENGLAND BUTT COMPANY
MANUFACTURERS OF
Machinery for Insulating Electrical Wires

Braiding, Taping, Winding, Twinning, Cabling, Stranding, Polishing and Measuring Machines. Cable Covering Braiders.

FINE CASTINGS A SPECIALTY

304 Pearl Street, Providence, R. I., U. S. A.

THE NEW METER

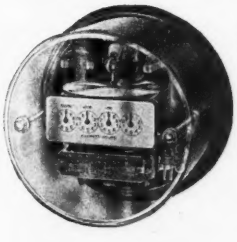
just developed by this company surpasses anything that has yet been accomplished in the meter art. Experts pronounce it as fulfilling the most exacting requirements of modern central-station practice.

Write for Bulletin

DUNCAN ELECTRIC MANUFACTURING CO.

LA FAYETTE, INDIANA.

SANGAMO METERS



SWITCHBOARD TYPE with Beveled Edge Plate Glass Cover

SANGAMO WATTMETERS

Type D for Direct Current.

Type F for Alternating Current.

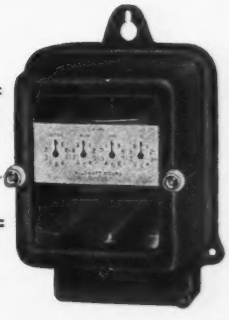
Bulletin No. 11, Switchboard Meters

Bulletin No. 12 (November, '08) Service Type Meters

SANGAMO WATTMETERS

Type D for Direct Current.

Type F for Alternating Current.



SERVICE TYPE WATTMETER with New Style Steel Case

SERVICE TYPE AMPERE-HOUR METER. case removed

For use with Electric Vehicles, Railway Train-Lighting Equipments and Central Station Batteries

Send for new Bulletin No. 14, just out

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS, U. S. A.

EDISON
PRIMARY BATTERIES

The Battery Energy You Do Not Get

is the energy that is wasted by internal resistance. This energy is leakage and consumes the elements just as does current taken from the external circuit.

In many batteries, particularly dry cells, this waste of current due to internal resistance is very high.

In Edison Primary Batteries it is lower than in any other form of battery. With Edison Batteries the loss of current from this cause is almost imperceptible and the result is that sufficient current is always at your command.

The low internal resistance of Edison Batteries adds to their life, making the necessity of renewals few and far between.

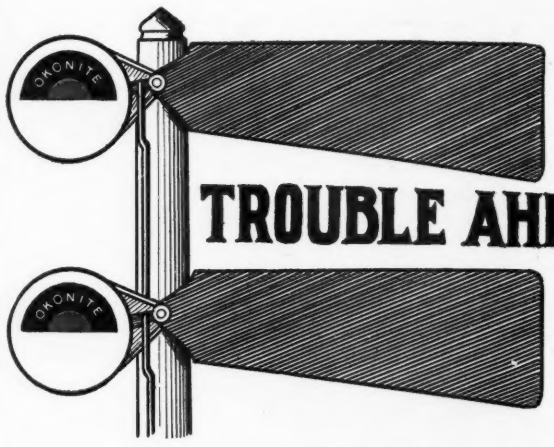
You must see the saving that gives you all of the current. You must also see the satisfaction in having sufficient current for your purpose all of the time.

No matter what your purpose is, there is an Edison Battery for it. Write for booklet on the subject you are specially interested in.

Edison Manufacturing Company

Victoria Road, Willesden
London, N. W.

3 Lakeside Avenue
Orange, N. J.



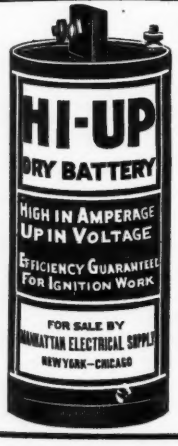
TROUBLE AHEAD

IS AVOIDED BY USING

OKONITE

SIGNAL WIRES
TELEPHONE AND TELEGRAPH WIRES
CABLES—POTHEADS—TAPE

The F. D. Lawrence Electric Co.
CINCINNATI, (2) OHIO



GUARANTEED to stand up equal to any Dry Battery on the market for ignition work

(MADE IN THREE SIZES)

Our guarantee means, we will CREDIT account, REPLACE batteries or REFUND amount paid for the batteries, including transportation charges, if they do not prove satisfactory.

Manhattan Electrical Supply Co.

17 Park Place
110 W. 42d St.
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CHICAGO

TRUMBULL
PANEL CIRCUITS

MAKE YOUR OWN PANEL BOARDS

WE WILL FURNISH PARTS AND CIRCUITS, WITH OR WITHOUT SWITCHES, FOR N. E. C. PLUG OR OPEN LINK FUSES. COMPLETE WITH LUGS, NUTS AND WASHERS, AND BUS-BARS IN STANDARD SIZES

THE TRUMBULL ELECTRIC MFG. COMPANY

NEW YORK
156 LIBERTY STREET

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65 AND 67 OLIVER ST.

German-American Citizens do not find it necessary to send back to their native land for food and clothing. Neither do American owners of German Flaming Arc Lamps find it necessary to send to Germany for their CARBONS, as good ones are made and sold much cheaper by the

NATIONAL CARBON COMPANY, Cleveland, Ohio.

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES
Manufactured by
THE WILLARD STORAGE BATTERY CO.
CLEVELAND, OHIO

Established 1774

JESSOP'S STEEL

For Tools, Dies, Magnets, Etc., also Crucible Sheet Steel

Wm. Jessop & Sons (Ltd.)
Chief American Office
91 JOHN STREET, NEW YORK
Manufactory, SHEFFIELD, ENG.

When buying **Carbon Brushes**

Look for the **Merit Mark**

Le Valley-Vitae Brushes are guaranteed 100 per cent in every count.

A TRIAL WILL PROVE THIS — SEND FOR A SAMPLE

Le Valley-Vitae Carbon Brush Co.
TREMONT — NEW YORK CITY

QUICK AND GOOD WORK
IS THE KIND THAT
BURNLEY
Soldering Paste
(Patented)
WILL HELP YOU TO DO
Put up in 2 oz., 4 oz., ½ lb., 1 lb., 5 lb., 10 lb. and 50 lb. package
STICK AND PASTE
The Burnley Battery and Mfg. Co.
NORTHEAST, PA.
DRY BATTERIES

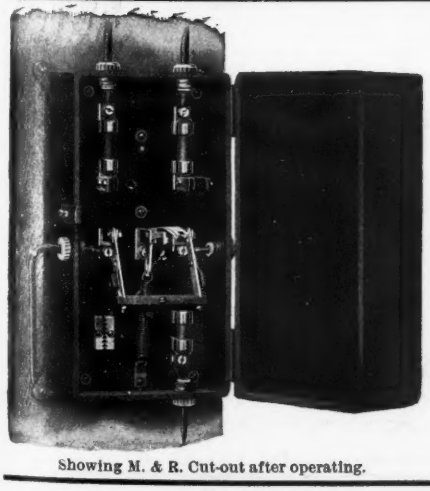
WARD LEONARD
RHEOSTATS
Hand operated an automatic types. The Standard of Excellence. If you use a resistance of any kind —confer with us—we can help you
WARD LEONARD ELECTRIC CO., - Bronxville, N. Y.

COMMUTATOR INSURANCE

That's what we offer, for there's no friction or wear with these brushes.

Being 90 per cent pure graphite insures low resistance, no sparking under varying load, longer wear and no greasing.

HOLMES FIBRE-GRAPHITE MFG. CO.
GERMANTOWN, PHILADELPHIA, PA.



Showing M. & R. Cut-out after operating.

Protect yourself and family, also your buildings, by installing one of our

ELECTRIC SAFETY VALVES

For prices, etc., address

ELECTRICAL MFG. CO.
OSHKOSH, WIS.

TRADE P&B MARK REGISTERED
Trade Mark Reg. U. S. Pat. Office.

INSULATION
IS
Perfect Insulation

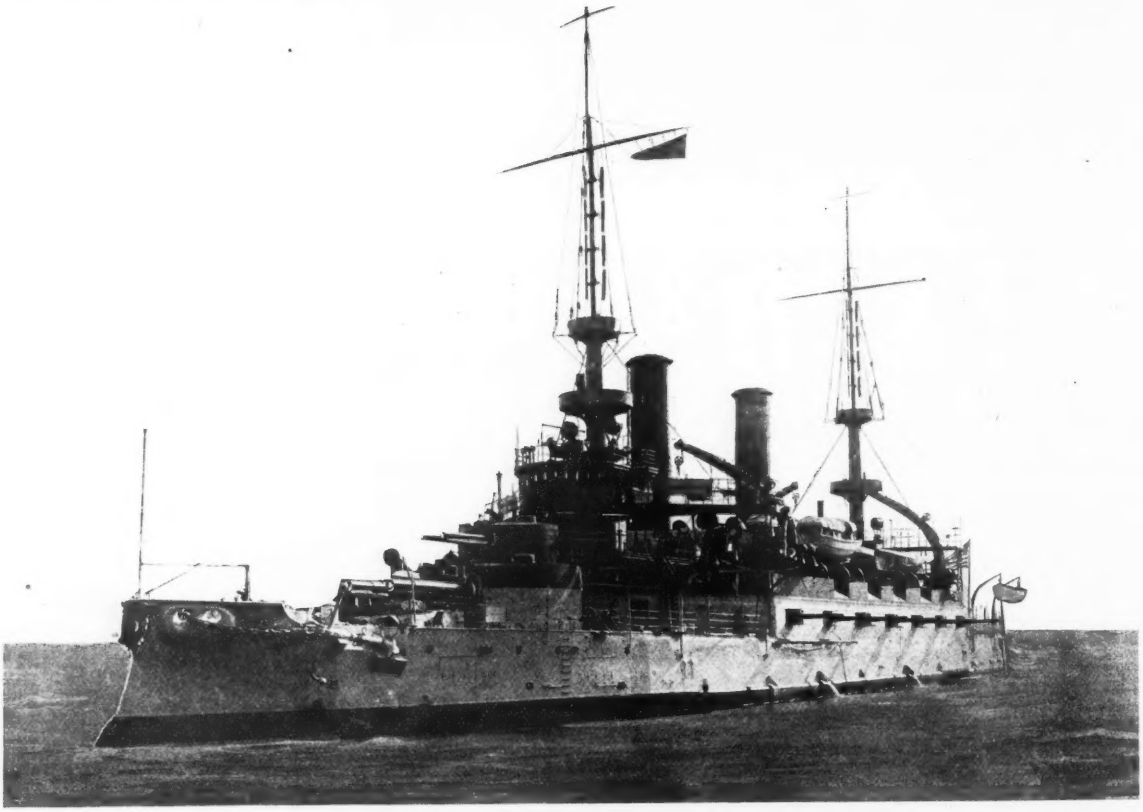
P & B goods possess the highest insulative efficiency and meet every requirement in electrical work.

P & B ELECTRICAL COMPOUNDS
P & B INSULATING VARNISHES
(Baking and Air Drying)
P & B INSULATING TAPE

Write for Specifications and Booklet No. 55.

THE STANDARD PAINT COMPANY
100 William Street — New York

THE PRIDE OF THE NAVY



KEARSARGE, U. S. N.

300,000

STERLING LAMPS

Being furnished the Navy under contract under most rigid testing and inspection

ARE YOU USING STERLING LAMPS?

ARE YOU AN AGENT FOR STERLING LAMPS?

Write us for contract conditions, prices, etc.
We have some interesting figures for you

LOOK FOR THE LICENSE LABEL IN THE STEM

STERLING ELECTRICAL MFG. CO.

WARREN, OHIO, U. S. A.

A BETTER YEAR IS COMING

There is no standing still.
It is either slide back---or forge ahead.

"Isn't that Brilliant Company going some?" has been overheard.
WE ARE.

With a good grade of lamp, a fair price schedule and the "know how to handle business," why not?

1909 Advertising is being mapped out right now, and every dealer who wants to can come in, and participate in some real, pulling, SENSIBLE advertising.

The "Brilliant" way of going after business is different from any other way.

Tie up with the "Brilliant" for 1909 and a better year is in store for you.

THE BRILLIANT ELECTRIC CO.

WORKS - CONNEAUT, OHIO
General Sales Offices - - 301-302 Electric Building, Cleveland, Ohio

Start the New Year right by using

COLUMBIA LAMPS

LOOK FOR THE LICENSE LABEL IN THE STEM

Columbia Lamps furnished in all types, both regular and special:

COLUMBIA CARBON FILAMENT
COLUMBIA STREET SERIES
Carbon, Gem and Tungsten

COLUMBIA GEM
COLUMBIA TUNGSTEN

COLUMBIA TANTALUM
COLUMBIA MINIATURE
Both Carbon and Tungsten

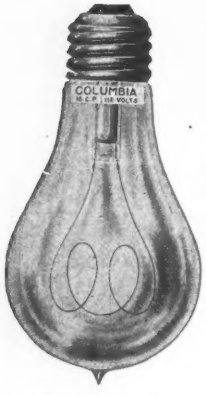
Prompt shipments. Write for Prices. Order now.

Columbia Tungsten

Type		Standard Pkg. Quantity
25	watt	100
40	"	50
60	"	50
100	"	24

TUNGSTEN MERIDIAN

40 watt, 3¾ in. round bulb
60 " 5 " " "



Regular Columbia

50% more light through the tip than other types—no increase of current consumption.

The COLUMBIA INCANDESCENT LAMP CO.

Established in 1889. **Main Office and Factory, 215-17-19 Locust Street, ST. LOUIS, MO.**

BRANCH OFFICES

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CHICAGO, 264-270 Fifth Avenue
BOSTON, 170 Purchase Street
PHILADELPHIA, 1221 Real Estate Trust Building
MEMPHIS, 26 Randolph Building
DALLAS, Wilson Building
SAN FRANCISCO, 111 New Montgomery Street

FOR JANUARY STOCK

ORDER "BOSTON" LAMPS

These are Renewed Lamps that are GUARANTEED and you can buy them for NINE CENTS in standard package quantities,

4 to 16 c.p., 100 to 130 volts, f.o.b. Danvers

DISCOUNTS TO DEALERS

BOSTON INCANDESCENT LAMP CO.

DANVERS, MASS.

1909

THE LAMP YEAR

Now is the time to turn your attention to the NEW YEAR'S requirements. Turn over a new leaf---economize by using ECONOMY LAMPS

One - third

off your

1909

Lamp Bills

without Reduction of Quality in your Lighting Service

Bright

renewed

Lamps

As efficient as any lamps made, cheaper than any other lamps known. A rapidly increasing circle of satisfied customers will give you the Economy habit

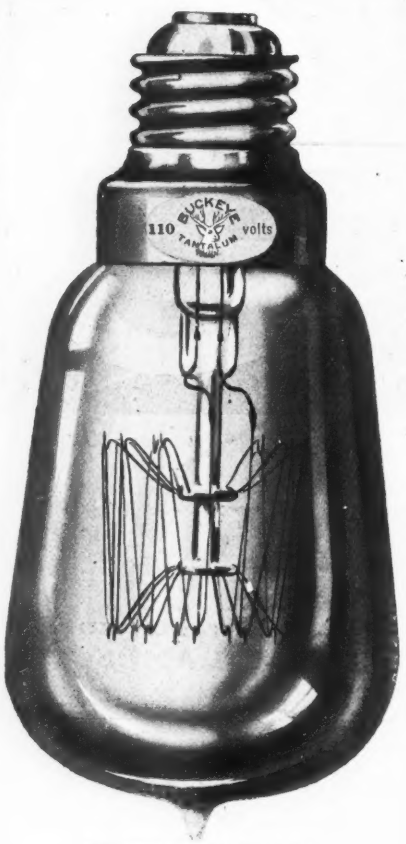
**As carefully made
Of the same material
By the same processes
As rigidly inspected
And uniformly good**

Let us quote you on your NEW YEAR Requirements

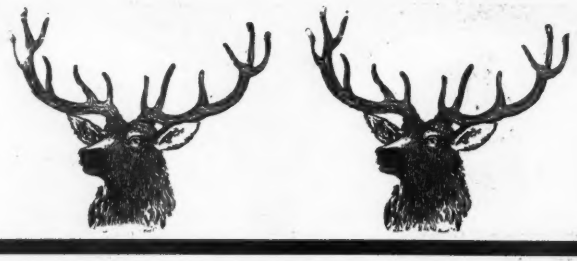
LICENSE LABEL

The Economy Electric Company

WARREN, OHIO



BUCKEYE TANTALUM



BUSI
GET

BUCK
TANTALUM

Buckeye Tantalum

Greatest Lamps made for GENERAL ILLUMINATION. As producers of new business these lamps are unequaled. They have the faculty of increasing the circle of satisfied customers.

New Types of Buckeye Gem Lamps

The steady march of improvements in all details has given **Buckeye Gem Lamps** an enviable reputation. Increased sales show every month the great extent to which consumers recognize the rare merit of this line.

Buckeye Gem Eighty-Watt Lamp

Made in bulbs which are standard in the carbon-filament sizes for 32 c. p. (the S S. 24-bulb), and it is believed that they will displace them larzely.

Gem Forty-Watt Buckeye Lamp

Made with **Oval Filaments** in bulbs which are standard in the carbon-filament sizes for 16 c. p. This 16 c. p. bulb (the S. S. 19 bulb) is standard in the Buckeye Gem fifty-watt size now on the market; consequently the Buckeye Gem forty-watt lamp in this size of bulb is similar to the Buckeye Gem fifty-watt lamp, although differing in the type of filament.

Prompt Deliveries

THE BUCKEYE

Main Office and Works,

LOOK FOR THE LICENSE LABEL IN THE STEM
8

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Pittsburg Office: 611 Empire Bldg., W. Ennes, Mgr.

Dallas, Texas, Office, 426 Linz Bldg., H. E. Wells, Mgr.

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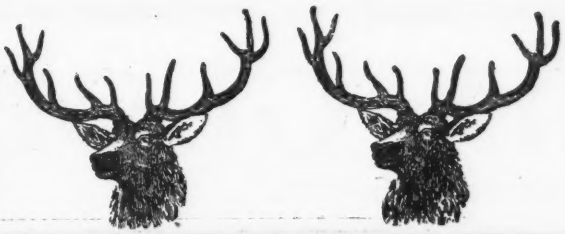
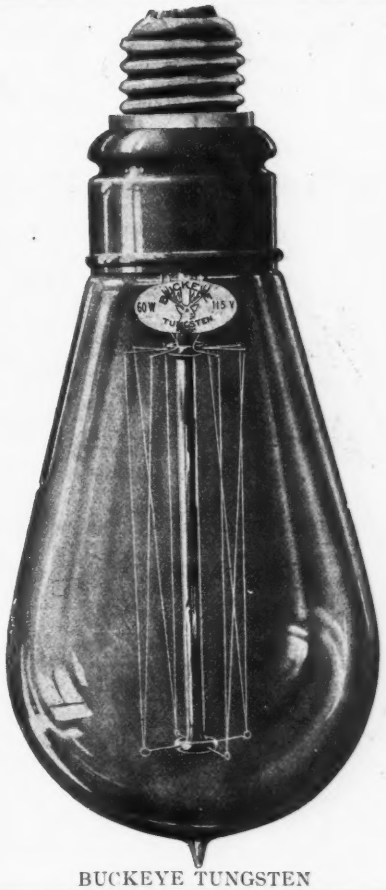


EYE TUNGSTEN



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Buckeye Tungsten

Big improvements, new models and increased efficiency make this line notable.

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1—4 C. P.
4—6 Volts
List Price, 50 cents

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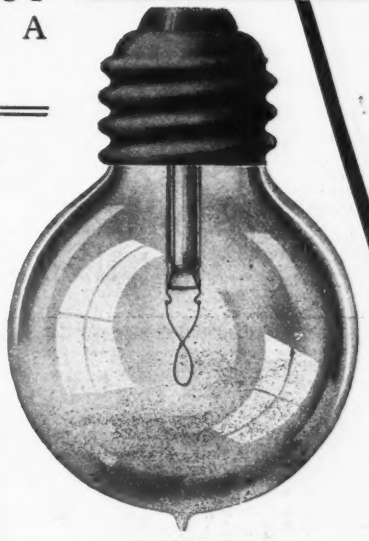

G—16½ Bulb
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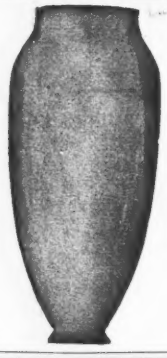
"Phoenix" Tungsten Glassware

produces best illuminating results. Increasing capacity gives the **Phoenix Tungsten Globes** their unique quality. They bring forth the full light-giving power of the lamp. Novel and artistic designs.



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do not blacken or crack under heat strain. No softening or melting. They give a clear, white light.

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FOSTORIA LAMPS

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FOSTORIA TANTALUM
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TUNGSTEN LAMPS

are universally admitted to be the greatest of modern illuminants.

Bryan-Marsh Tungsten Lamps

are the best of all Tungstens—they satisfy the most critical, save you 65 per cent of your lighting bill and give you better light and more reliable service than any other type of incandescent lamp.

We have recently collected and published figures showing the positive saving in cost of these Tungstens over the ordinary carbon filament. The economy lies in the lower current consumption of the **Bryan-Marsh Tungsten.**

Reduced maintenance cost and high efficiency put these lamps among the big money-savers. Let us quote you on your 1909 requirements.

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Bryan-Marsh Tungsten Lamps	25	100	$0.85	$0.90	**Bryan-Marsh Tungsten Lamps**
	40	50	1.10	1.15	
	60	50	1.40	1.47	
	100	24	1.75	1.85	
	40 No. 1 Meridian	24	1.50	1.50	
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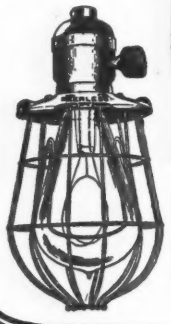

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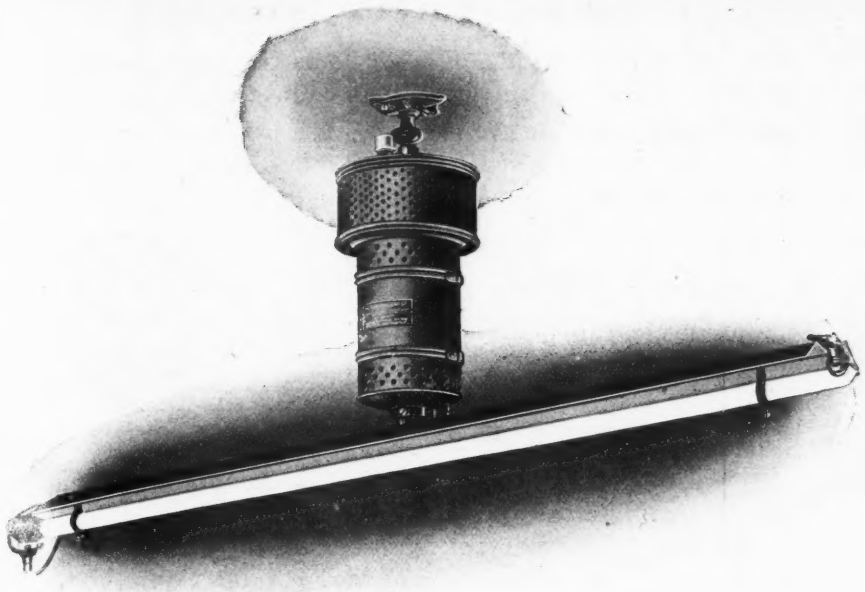

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Type F—60-Cycle, A. C.

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Did you ever hear such an astonishing claim made for any artificial light before?

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For Tungsten Lamps

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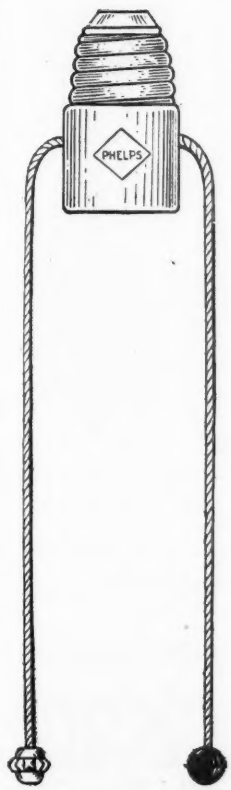

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Short People
Comfort and Convenience

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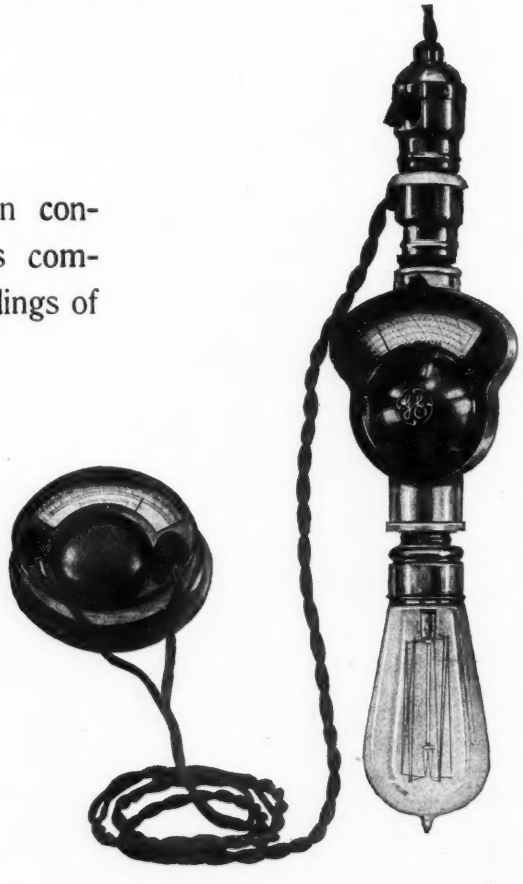
The Watt Indicator can also be used in connection with a pocket voltmeter. This combination outfit permits simultaneous readings of both watts consumed and line voltage.

The instruments are small and compact and can be carried in the pocket.



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Physicians and occulists have long advocated the adoption of some system of lighting by which the eye would be protected from the glare of modern lighting units

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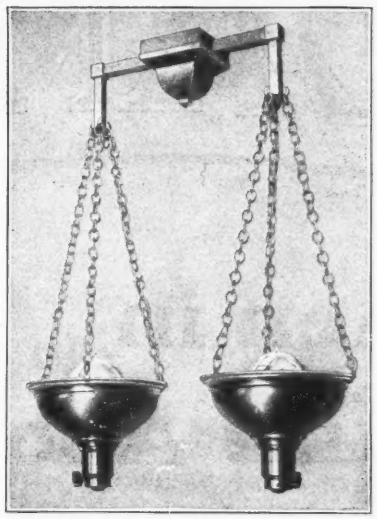

The lights are entirely concealed by inverted reflectors.

Room illuminated with single fixture containing one 60-watt Tungsten.

Physicians unite with Central Station men in commending this system.

It removes the one great drawback to the free use of the Tungsten lamp—the blinding glare of the naked filament no more offends the eye where the I-Comfort System is in use.

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(Tune "A Big Night Tonight")

It looks to us like a big year that's here!
Big year that's here!
Big year that's here!
It looks to us like a big year that's here!
It looks like a big year that's here!

Yours for Noblac Inner Globes

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MIXERS of GLASS and SCIENCE

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COST NO MORE THAN INFERIOR GRADES OF CARBONS. THE USE OF "ELECTRA" CARBONS INSURES A DEGREE OF BRIGHTNESS OF LIGHT COMBINED WITH STEADINESS OF ARC NOT TO BE OTHERWISE OBTAINED. THEY DO NOT BLACKEN THE GLOBES.

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A Scientific Investigation of Fuse Construction
Our Results Prove That We Have a
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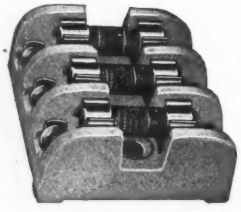

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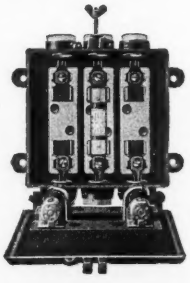

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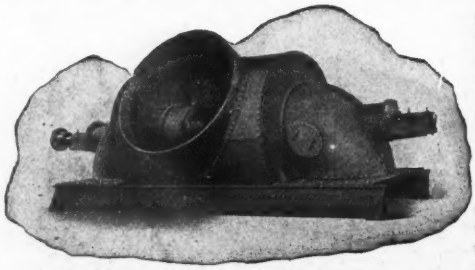

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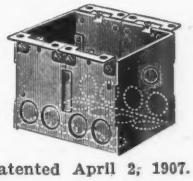
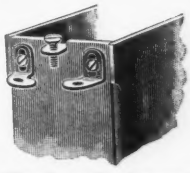
Superior to all cast-iron boxes. Made from 14-gauge Steel. Takes all makes of Switches and Receptacles.



Patented April 2, 1907.

For OLD and NEW work

"CCB" Shallow, 2 inches deep.



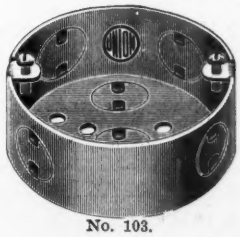
The above Ear is regularly furnished.

Type "C" Ear furnished only when specified.

Made in the following depths: 2", 2½", 2¾", 3", 3¼" and 3½", suitable for new or old installation. Can be built up into any number of Gangs by using a screwdriver and inserting spacers.

"UNION" CONDUIT BOXES AND COVERS

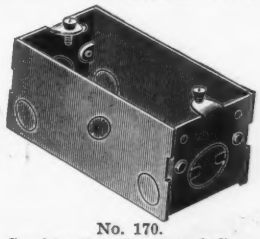
meet every demand of the Electrical Contractor.



No. 103.

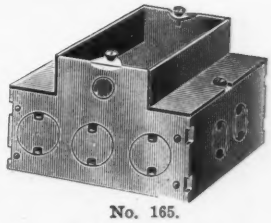
No. 103J.

No. 107D.



No. 170.
Combination Loom and Conduit Box for thin partitions and outside wall work; takes all shallow switches.

Patented April 2, 1907.



No. 165.
For push-button, rotary rectangular base, switches and plug receptacles.

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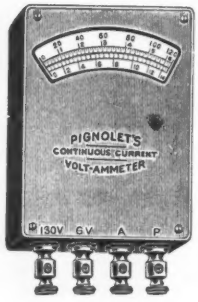

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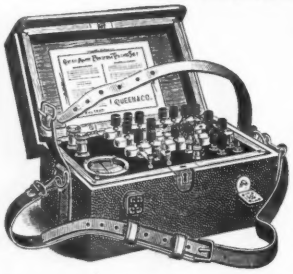

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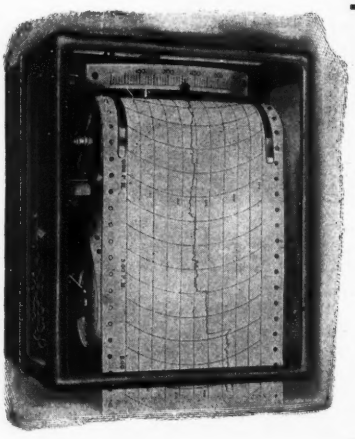

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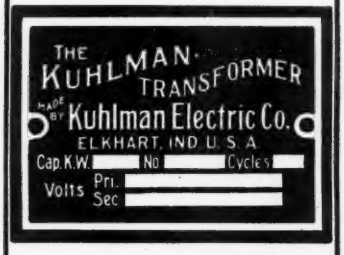

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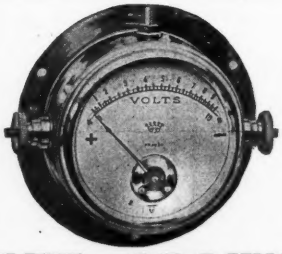

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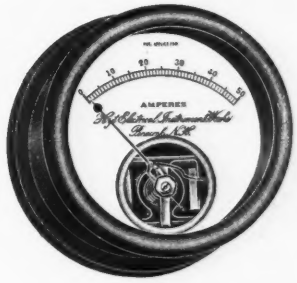

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Hoyt Electrical Meters for direct-current measurements present the highest excellence attained in this field. We make them suitable for all classes of work. Their precision is unvarying. A constantly increasing circle of users marks the public recognition of their superior excellence. Write for bulletins E R and let us put you on our mailing list to receive others that will be issued from time to time.

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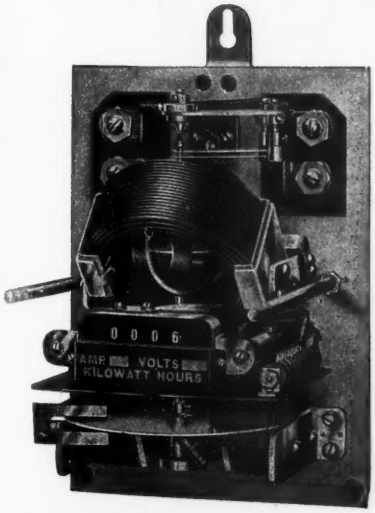

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Catalog No. 4110
Type "C" for ½-inch Conduit

Catalog No. 4111
Type "E" for ½-inch Conduit

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Type "A" for ½-inch Conduit

Catalog No. 4113
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These are the new N. E. Code Standard Conduit Fittings that make pipe work easy. The rectangular openings for all styles of ½-inch, ¾-inch and 1-inch sizes are identical, so that any cover or any fitting will go on them all.

They Are Made for Standard Fielding Receptacles and Rosettes

These are the fittings you already have in stock so that no special types need be carried when you want a receptacle or a rosette outlet, for Fielding's fit them all.

Only 4 or 5 threads need be cut on your entering conduit, the set-screw does the rest, AND when there is more than one conduit opening, as in Type "C," ONLY ONE CONDUIT need be threaded, for the set-screw will hold the others as tight as the threading.

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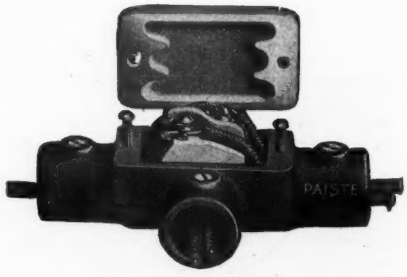
Type "C" with No. 50724

Catalog No. 5264
10-amp. Switch Fitting



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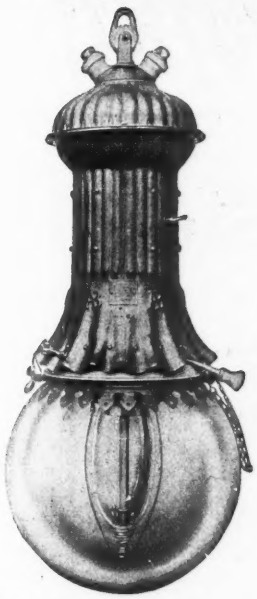

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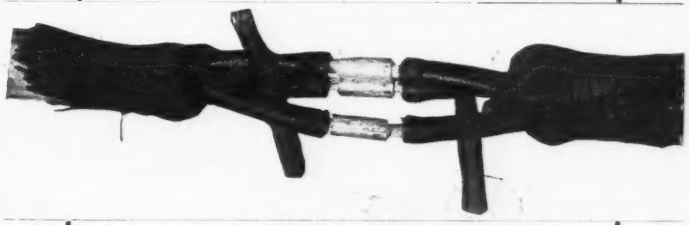

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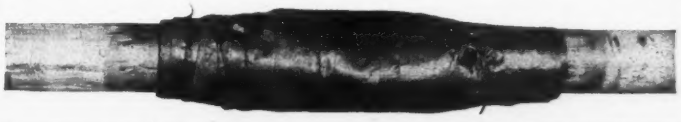
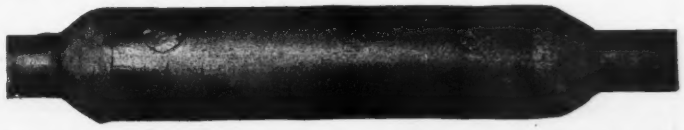


Fifth Stage.



The Completed Minerallac Joint.

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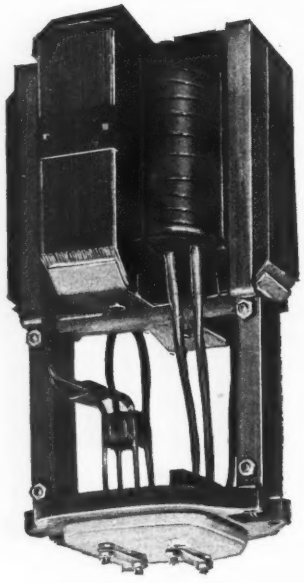

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Alternating-Current Switchboard Ammeters and Voltmeters

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Each and every switch carefully inspected with the current on before shipment.

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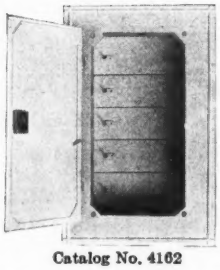
Sectional Iron Panel Boxes



Catalog No. 4162

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STEAM TURBINES AND GENERATORS

In Capacities from 300 to 20,000 K. W.

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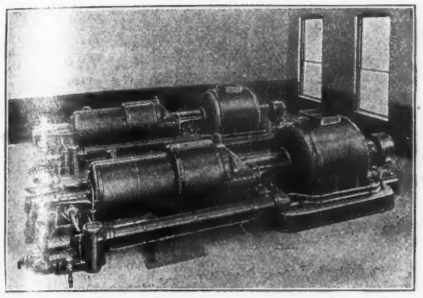

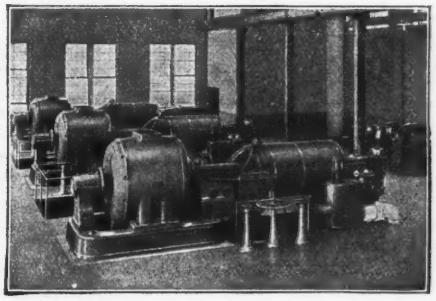

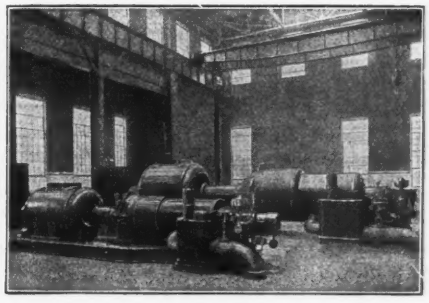

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Field core built up of steel discs, each in one piece, or of steel forgings, giving high magnetic permeability and great strength.

Coils placed in radial slots, thereby avoiding side pressure on slot insulation and the complex stresses resulting from centrifugal force, which, in these rotors, acts normal to the flat surface of the strip windings.

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End connections securely held by chrome-nickel steel rings.

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Enclosed type eliminating noise of operation.

Coils completely wound and insulated before being placed on the core, thus obviating the risk of defective insulation.

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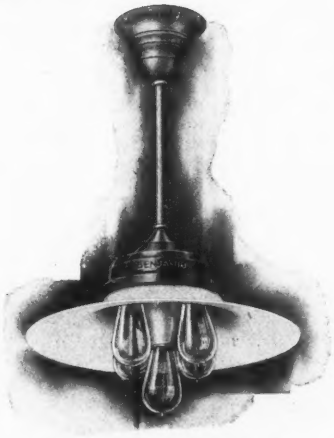

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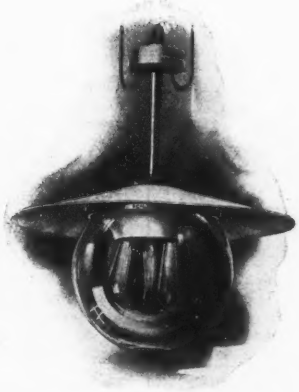

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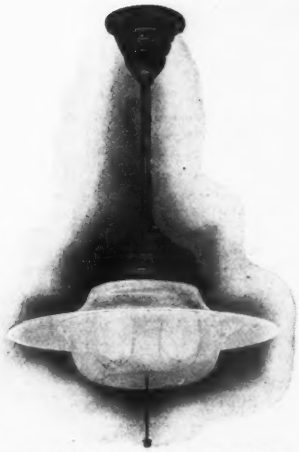

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Diehl Mfg. Co.
Doubleday-Hill Electric Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Emerson Electric Manufacturing Co.
Fort Wayne Electric Works.
General Electric Co.
Gregory Electric Co.
Guarantee Electric Co.
Holtzer-Cabot Electric Co.
Jeffrey Mfg. Co.
Kimble Electric Co.
Mechanical Appliance Co.
Novelty Electric Co.
Richmond Electric Co.
Ridgway Dynamo & Engine Co.
Stow Mfg. Co.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Warren Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

ELECTRIC ARC WELDERS
The Electric Controller & Mfg. Co.

ELECTRIC COOKING APPARATUS
American Electric Heater Co.
Doubleday-Hill Electric Co.
Simplex Electric Heating Co.

ELECTRIC RAILWAYS
Allis-Chalmers Co.
Arnold Co., The
Byllesby & Co., H. M.
Darlington, F. W.
Dodge & Day
Fergus & Co., W. L.
General Electric Co.
Hallberg, J. H.
Hammer, Wm. J.
Humphrey, Henry H.
Iron City Eng. Co.
Kelly Eng. Co., John F.
Kitfield, Edw. H.
Knowles, Edw. R.
Mershon, Ralph D.
New England Eng. Co.
Reed, Warren B.
Westinghouse El. & Mfg. Co.
White & Co., J. G.

CLASSIFIED INDEX—Continued.

ELECTRICAL DECORATIONS
Doubleday-Hill Electric Co.

ELECTRIC GAS LIGHTING
Electric Goods Mfg. Co.

ELECTRIC IRONS
American Electric Heater Co.
Guaranty Electric Heater Co.
Prometheus Electric Co.
Simplex Elec. Heating Co.

ELECTRIC LIGHTERS
Stanley & Patterson

ELECTRIC LOCOMOTIVES
General Electric Co.
Jeffrey Mfg. Co., The
Westinghouse Electric & Mfg. Co.

ELECTRIC SOLDERING IRONS
American Electrical Heater Co.
Guaranty Electric Heater Co.
Simplex Electric Heating Co.

ELECTRICAL SUPPLIES
Bates, Putnam A.
Bissell Co., The F.
Central Electric Co.
Chase-Shawmut Co.
Commonwealth Edison Co.
Crocker-Wheeler Co.
Doubleday-Hill Electric Co.
Electric Appliance Co.
Electric Goods Mfg. Co.
General Electric Co.
International Electric Meter Co.
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Manhattan Electrical Supply Co.
Metropolitan Electrical Supply Co.
Novelty Electric Co.
Paiste Co., H. T.
Partrick, Carter & Wilkins Co.
Stanley & Patterson
Western Electric Co.
Weston Electrical Instrument Co.

ELECTROLIERS
Goodwin & Kintz Co., The

ELECTROMAGNETS
Western Electric Co.
Westinghouse Electric & Mfg. Co.

ELECTRO-PLATING MACHINERY.
Crocker-Wheeler Co.
General Electric Co.

ELEVATING AND CONVEYING MACHINERY
Jeffrey Mfg. Co.

ENGINES, GAS, GASOLINE AND OIL
Allis-Chalmers Co.
American Diesel Engine Co.
Buckeye Engine Co.
Minn. Steel & Machy. Co.
Westinghouse Machine Co.

ENGINES, STEAM
Allis-Chalmers Co.
American Engine Co.
Ball Engine Co.
Buckeye Engine Co.
Minneapolis Steel & Machy. Co.
Ridgway Dynamo & Engine Co.
Rochester Machine Tool Works
Westinghouse Machine Co.

ENGINEERS AND CONTRACTORS
Ahlm, C. E. F.
American Bridge Co.
Arnold Co., The
Badt & Co., F. B.
Bates, Putnam A.
Burch, Edw. P.
Byllesby & Co., H. M.
Clement, Edward E.
Darlington, F. W.
Dodge & Day
Fergus & Co., W. L.
Hallberg, J. H.
Hanchett, George T.
Hickey Contracting Co.
Humphrey, Henry H.
Hunt & Co.
Iron City Engineering Co.
Jackson, D. C. & W. B.
Kelly Engineering Co., John P.
Kitfield, Edward H.
Kohler Bros.
Knowles, Edward R.
Lansingh, Van Rensselaer
Lyndon, Lamar
McMeen, Samuel G.
Marshall, Albert J.
Mershon, Ralph D.
Miller, Kempster B.
New England Engineering Co.
Pillsbury, Chas. L.
Radford, John A.
Reed, Warren B.
Ruebel & Wells
Sargent & Lundy
Schott, W. H.
Stanton, Le Roy W.
Storer, Simon B.
White & Co., J. G.

EXPOSITION, ELECTRICAL
Electrical Trades Exposition Co.

FANS AND FAN MOTORS
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Commonwealth Edison Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Doubleday-Hill Electric Co.
Edison Manufacturing Co.
Emerson Electric Manufacturing Co.
Fort Wayne Electric Works
General Electric Co.
Jeffrey Mfg. Co.
Stanley & Patterson
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FAN MOTOR RESISTANCES
Ward Leonard Electric Co.

FIBRE
American Vulcanized Fibre Co.
Fibre Conduit Co.

FIREPLACE, ELECTRIC
Rathbone & Panigot Co.

FIXTURES, GAS AND ELECTRIC
Benjamin Electric Mfg. Co.
Federal Electric Co.

FLASHERS
Bissell Co., The F.
Electric Motor & Equipment Co.
Haller Machine Co.
Reynolds Electric Flasher Mfg. Co.
Schneider, C. O.

FLEXIBLE COUPLINGS FOR SHAFTS
The Electric Controller & Supply Co.

FLAT IRONS, ELECTRIC
Am. Elec. Heater Co.
General Electric Co.
Prometheus Electric Co.
Simplex Elec. Heating Co.
Westinghouse Elec. & Mfg. Co.

FLEXIBLE SHAFTS
Stow Mfg. Co.

FRICTION TAPE
Johns-Manville Co., H. W.
Standard Paint Co.

FUSES
Chase-Shawmut Co.
Central Elec. Co.
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Manhattan Electrical Supply Co.
Pass & Seymour, Inc.
Sachs Co., The
Wesco Supply Co.
Western Electric Co.

FUSE WIRE
Chase-Shawmut Co.
Chicago Fuse Wire Mfg. Co.
Wesco Supply Co.
Western Electric Co.

GAINS, STEEL
Belden Mfg. Co.

GAS PRODUCER POWER PLANTS
Minn. Steel & Machy. Co.
Westinghouse Machine Co.

GEARS
New Process Raw Hide Co.

GENERATORS
Allis-Chalmers Co.
American Engine Co.
C. & C. Electric Co.
Crocker-Wheeler Co.
Ridgway Dynamo & Engine Co.
Triumph Electric Co.
Western Electric Co.

GLASS TUBING
Lippincott Glass Co., The

GLOBES, SHADES, ETC.
Fostoria Glass Specialty Co.
Holophane Co.
Lippincott Glass Co., The
Phœnix Glass Co.
Wesco Supply Co.

GRAPHITE
Dixon Crucible Co., Joseph
Holmes Fibre Graphite Co.

GROUND CONNECTION CLAMPS
Chase-Shawmut Co.

GROUND POINTS, PLATES AND CONTACTS
Lord Electric Co.

HANGERS, CONDUIT AND MOULDING.
Chase-Shawmut Co.

HEATING APPARATUS
American Electrical Heater Co.
Grinnell Electric Heater Co.
Guaranty Elec. Heater Co.
Johns-Manville Co., H. W.
Prometheus Electric Co.
Simplex Electric Heater Co.
Ward Leonard Electric Co.

HEATING (EXHAUST STEAM)
American District Steam Co.

HOISTING MACHINERY
Allis-Chalmers Co.
Brown Hoisting Machinery Co.
Jeffrey Mfg. Co.

HOLDERS, ELECTRICIANS' DRILL BIT
Star Expansion Bolt Co.

HYDRAULIC MACHINERY
Allis-Chalmers Co.

IMPREGNATING APPARATUS
Buffalo Fdy. & Machine Co.
Devine & Co., J. P.
Mitchell, W. E. G.

IMPREGNATING COMPOUND
Mitchell, W. E. G.

INNER GLOBES
Fostoria Glass Specialty Co.
Macbeth-Evans Glass Co.
Phœnix Glass Co.

INSTRUMENTS
Atwater-Kent Mfg. Co.
Bristol Co.
Central Laboratory Supply Co.
Cutter Electrical Mfg. Co.
Doubleday-Hill Electric Co.
Duncan Electric Mfg. Co.
Eldredge Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Hoyt Electrical Instrument Works
International Electric Meter Co.
Johns-Manville Co., H. W.
Keystone Electrical Instrument Co.
Leeds & Northrup Co.
Machado & Roller
Oelschlaeger Bros.
Pignolet, Louis M.
Queen & Co., Inc.
Siemens & Halske, A. G.
Wagner Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.
Weston Electrical Instrument Co.

INSULATING CEMENTS
Mitchell, W. E. G.

INSULATING COMPOUNDS
Electric Cable Co.
Minerallac Co.
Mitchell, W. E. G.

INSULATING MACHINERY
American Insulating Machinery Co.
New England Butt Co.

INSULATING PAINTS
Standard Paint Co.

INSULATORS AND INSULATING MATERIAL
American Electrical Works
American Vulcanized Fibre Co.
Brixey, W. R.
Brookfield Glass Co.
Central Electric Co.
Chicago Mica Co.
Commonwealth Edison Co.
Detroit Insulated Wire Co.
Doubleday-Hill Electric Co.
Dunton Co., M. W.
Elm City Engineering Co.
General Electric Co.
Hemingray Glass Co.
Indiana Rubber & Insulated Wire Co.
Johns-Manville Co., H. W.
Lima Insulator Co.
Locke Insulator Mfg. Co.
Mass. Chemical Co.
Mica Insulator Co.
Minerallac Co.
Mitchell, W. E. G.
Munsell & Co., Eugene
New Lexington High Voltage Porcelain Co.
New York Insulated Wire Co.
Okonite Co.
Pass & Seymour, Inc.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground Cable Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

IRIDIO PLATINUM, WIRE AND SHEET
Baker & Co., Inc.

IRONS, ELECTRIC
American Electrical Heater Co.
General Electric Co.
Guaranty Electric Heater Co.
Prometheus Electric Co.
Simplex Electric Heating Co.
Westinghouse Electric & Mfg. Co.

JOINTS, WIRE
Harvard Electric Co.

JUNCTION BOXES
Bossert Electric Construction Co.
D. & W. Fuse Co.

LAMP COLORING
Electric Motor & Equipment Co,

LAMP GUARDS
Foster, Herbert T.
Greenwood Mfg. & Supply Co

LAMP-MAKING MACHINERY
Dwyer Machine Co.
Fahn & McJunkin

LAMPS, ARC
Adams-Bagnall Electric Co.
Bissell Co., The F.
Central Electric Co.
Doubleday-Hill Electric Co.
Excello Arc Lamp Co.
Fort Wayne Electric Works
General Electric Co.
Jandus Electric Co.
Nernst Lamp Co.
Queen & Co.
Stave Electrical Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co

LAMPS, DECORATIVE
Central Electric Co.
General Electric Co.

LAMPS, INCANDESCENT
Banner Electric Co.
Bay State Lamp Co.
Boston Incandescent Lamp Co.
Brilliant Electric Co.
Bryan Marsh Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Incandescent Lamp Co.
Colonial Electric Co.
Commonwealth Edison Co.
Doubleday-Hill Electric Co.
Economical Elec. Lamp Co.
Economy Electric Co.
Electrical Accessories Co.
Fort Wayne Electric Works
Fostoria Incandescent Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
General Incandescent Lamp Co.
Germania Electric Lamp Co.
Johns-Manville Co., H. W.
New York & Ohio Co.
Shelby Electric Co.
Standard Electrical Mfg. Co.
Sterling Electrical Mfg. Co.
Sunbeam Incandescent Lamp Co.
Warren Electric & Specialty Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Westinghouse Lamp Co.

LAMPS, MERCURY VAPOR
Cooper Hewitt Electric Co.

LIFTING MAGNETS
The Electric Controller & Mfg. Co.

LIGHTING PLANTS
Allis-Chalmers Co.
Crocker-Wheeler Co.
Doubleday-Hill Electric Co.
Fort Wayne Electric Works
General Electric Co.
Stanley & Patterson
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS
D. & W. Fuse Co.
General Electric Co.
Gifford Elec. Mfg. Co.
Lord Electric Co.
Westinghouse Electric & Mfg. Co.

LINE MATERIAL
Bissell Co., The F.
Johns-Manville Co., H. W.
Klein & Sons, Mathias
Peirce Specialty Co.

LOCOMOTIVES, ELECTRIC
Jeffrey Mfg. Co.

LUBRICANTS
Dearborn Drug & Chem. Works

MACHINE TOOLS AND MACHINERY
Allis-Chalmers Co.
Jeffrey Mfg. Co.
New England Butt Co.

MACHINES, WIRE MEASURING
Minn. Electric & Construction Co.

MAGNET WIRES
(See Wires and Cables)

MAGNETIC CLUTCHES
The Electric Controller & Mfg. Co.

MAGNETIC FRICTION BRAKES
The Electric Controller & Mfg. Co.

MAGNETIC SOLENOIDS
Cutler-Hammer Mfg. Co.
The Electric Controller & Mfg. Co.

MAGNETIC SWITCH CONTROLLERS FOR LARGE MOTORS
Cutler-Hammer Mfg. Co.
The Electric Controller & Mfg. Co.

MALLEABLE CASTINGS
Jeffrey Mfg. Co.

MAST-ARMS
Bissell Co., The F.
Brady, T. H.

METALS
Baker & Co., Inc.
Phosphor-Bronze Smelt. Co.

CLASSIFIED INDEX—Continued.

METERS
Columbia Meter Co.
Doubleday-Hill Electric Co.
Duncan Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
International Electric Meter Co.
Johns-Manville Co., H. W.
Pignolet, L. M.
Sangamo Electric Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

MICA
Chicago Mica Co.
Mica Ins. Co.
Munsell & Co., Eugene

MINING MACHINERY
Allis-Chalmers Co.
Jeffrey Mfg. Co.

MOTORS
(See Dynamos & Motors)

NAME-PLATES
Schwerdtle Stamp Co., The

OUTLET BOXES
Bossert Electric Construction Co.
Chase-Shawmut Co.
Chicago Fuse Wire & Mfg. Co.

OUTLET BOX RECEPTACLES
Benjamin Electric Mfg. Co.

PAINTS, INSULATING
Dixon Crucible Co., Joseph
Massachusetts Chemical Co.
Standard Paint Co.

PANEL-BOARDS
Lang Electric Co., The J.
Trumbull Electric Mfg. Co.

PATENT SOLICITORS
Clement, Edward E.
Duval, Edw. S.
Siggers & Siggers

PHOSPHOR-BRONZE
Phosphor-Bronze Sm. Co., Ltd.

PHOTOMETERS
Dwyer Machine Co.
Electric Motor & Equipment Co.

PHOTOMETER STANDARDS
Electrical Testing Laboratories

PIGTAILS, CARBON BRUSH
Belden Mfg. Co.

PINIONS
New Process Raw Hide Co.

PLATINUM PRODUCTS
American Platinum Works
Baker & Co., Inc.

PLATINUM WIRE AND SHEET, PLATINUM CRUCIBLES AND DISHES, PLATINUM RIVETS
American Platinum Works
Baker & Co., Inc.

PLUGS, ATTACHMENT
Pass & Seymour, Inc.

PLUGS, FUSE
Pass & Seymour, Inc.

POLES, BRACKETS, PINS, TIES, CROSS-ARMS, CLIMBERS, ETC.
Bissell Co., The F.
Brady, T. H.
Brooks, Hall L.
Doubleday-Hill Electric Co.
Johns-Manville Co., H. W.
Kellogg Switch. & Sup. Co.
Klein & Sons, Mathias
Lindsley Bros. Co., The
National Pole Co.
Pacific Coast Pole Co.
Standard Cedar & Lumber Co.
Torrey Cedar Co.
Wittenberg Cedar Co.
Worcester Co., C. H.
Wyckoff Pipe & Creosoting Co

PUMPING MACHINERY
Allis-Chalmers Co.
Minn. Steel & Machy. Co.

PUSH-BUTTONS
Cutler-Hammer Mfg. Co.
Electric Goods Mfg. Co.
Manhattan Electrical Supply Co.
Partrick, Carter & Wilkins Co.
Ward Leonard Electric Co.

RAIL BONDS
Chase-Shawmut Co.
Dossert & Co.
General Electric Co.
Johns-Manville Co., H. W.
Lord Electric Co.
Roebling's Sons Co., John A.

RAIL JOINTS
Rail Joint Co.

RAILWAY SPECIALTIES, ELECTRIC
Blake Signal & Mfg. Co.
Central Electric Co.
Doubleday-Hill Electric Co.
General Electric Co.
Johns-Manville Co., H. W.
Rail Joint Company, The
Westinghouse Electric & Mfg. Co.

REFLECTORS
Frink, I. P.
Holophane Co.
National X-Ray Reflector Co.
Phœnix Glass Co.

REPAIRS
Commonwealth Edison Co.
Gregory Electric Co.
Guarantee Electric Co.
Waterbury & Co.

RESISTANCE BANKS AND UNITS
Cutler-Hammer Mfg. Co.
The Electric Controller & Mfg. Co.
Ward Leonard Electric Co.

RESISTANCES
Cutler-Hammer Mfg. Co.
Simplex Electric Heating Co.
Ward Leonard Electric Co.

REVERSING CONTROLLERS FOR CRANES AND SIMILAR SERVICE
Cutler-Hammer Mfg. Co.
The Electric Controller & Mfg. Co.

RHEOSTATS
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Cutter Electrical & Mfg. Co.
General Electric Co.
Schureman Co., J. L.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co.

RUBBER, MOLDED
Massachusetts Chemical Co.

SCALES, AUTOMATIC
Avery Scale Co., The

SCHOOLS AND COLLEGES
Highland Park College

SEALS
Schwerdtle Stamp Co., The

SECOND-HAND MACHINERY
Bissell Co., The F.
Gregory Electric Co.
Guarantee Electric Co.

SHADES
Foster, Herbert T.
Hubbell, Harvey, Inc.

SHADEHOLDERS
Hubbell, Harvey, Inc.

SIGNS, ELECTRIC
Electric Motor & Equipment Co.
Federal Electric Co.
Haller Sign Works, Inc.

SLEEVINGS
Belden Mfg. Co.
Dunton Co., M. W.

SMOKESTACKS, STEEL
Minn. Steel & Machy. Co.

SOCKETS
Federal Electric Co.
Hubbell, Harvey, Inc.
Paiste Co., H. T.
Trumbull Electric Mfg. Co.

SOLDERING STICKS AND PASTE
Allen Co., L. B.
Belden Mfg. Co.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Chase-Shawmut Co.
Dunton Co., M. W.

SOLENOIDS
Ward Leonard Electric Co.

SPARK COILS
Electric Goods Mfg. Co.
Holtzer-Cabot Electric Co.
Manhattan Electrical Supply Co.

SPARKING POINTS
Baker & Co., Inc.

SPEAKING TUBES
Central Electric Co.
Manhattan Elec. Supply Co.
Ostrander & Co., W. R.
Wesco Supply Co.
Western Electric Co.

SPECIAL OVERLOAD NO-VOLTAGE AND RESET CIRCUIT-BREAKERS
Cutler-Hammer Mfg. Co.
The Electric Controller & Mfg. Co.
Ward Leonard Electric Co.

SPECIALTIES
Benjamin Electric Mfg. Co.
Chase-Shawmut Co.
Cutler-Hammer Mfg. Co.
Doubleday-Hill Electric Co.
Novelty Electric Co.
Paiste Co., H. T

SPEED INDICATORS
Weston Electrical Inst. Co.

SPRINGS
Barnes Co., Wallace
Cary Spring Works
Manross, F. N.

STAGE LIGHTING APPARATUS
Chase-Shawmut Co.

STANDARD CELLS
Weston Electrical Instrument Co.

STAPLES, INSULATED
Blake Signal & Mfg. Co.

STATIONERY, DIE EMBOSSED
Wiggins Co., The John B.

STEAM SPECIALTIES
American District Steam Co.
New Process Raw Hide Co.

STEEL
American Bridge Co.
Jessop & Sons, Ltd., Wm.

STEEL STAMPS
Schwerdtle Stamp Co., The

STENCILS
Schwerdtle Stamp Co., The

STOKERS
Babcock & Wilcox Co.
Westinghouse Machine Co.

STORAGE BATTERIES
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
Westinghouse Machine Co.
Willard Storage Battery Co.

SUPPLIES, GENERAL ELECTRICAL
Bissell Co., The F.
Central Electric Co.
Chase-Shawmut Co.
Commonwealth Edison Co.
Manhattan Elec. Supply Co.
Stanley & Patterson.
Wesco Supply Co.
Western Electric Co.
Zenco Electrical Supply Co.

SWITCHBOARDS
Allis-Chalmers Co.
Bissell Co., The F.
Bossert Electric Construction Co.
Crocker-Wheeler Co.
Doubleday-Hill Electric Co.
Eaton Electrical Mfg. Co.
Electric Goods Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Trumbull Electric Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SWITCHES, ETC
Central Electric Co.
Cutler-Hammer Mfg. Co.
Cutter Electrical Mfg. Co.
Doubleday-Hill Electric Co.
Electric Controller & Mfg. Co.
General Electric Co.
Hart & Hegeman Mfg. Co.
Hart Mfg. Co.
Lang Electric Co., The J.
Lawrence Electric Co., F. D.
Lord Electric Co.
Pacific Electric & Mfg. Co.
Partrick, Carter & Wilkins Co.
Pass & Seymour, Inc.
Pettingell-Andrews Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

TABLET BOARDS
Doubleday-Hill Electric Co.

TAPE AND SPLICING COMPOUND
Doubleday-Hill Electric Co.
Massachusetts Chemical Co.
Minerallac Co.
Okonite Co.

TAPES
Belden Mfg. Co.

TELEPHONES
Atwater-Kent Mfg. Co.
Automatic Electric Co.
Central Electric Co.
Doubleday-Hill Electric Co.
Electric Goods Mfg. Co.
Holtzer-Cabot Electric Co.
Kellogg Switchboard & Supply Co.
Manhattan Electrical Supply Co.
Novelty Electric Co.
Stanley & Patterson
Western Electric Co.
Wire & Telephone Co. of America

TELEPHONE SERVICE
American Bell Telephone Co.
Chicago Telephone Co.
New York Telephone Co.

TESTING
Electrical Testing Laboratories

THEATER DIMMERS
Cutler-Hammer Mfg. Co.
Simplex Electric Heating Co.
Ward Leonard Electric Co.

TIES, CROSS-ARMS, BRACKETS, PINS, CLIMBERS, ETC.
Bissell Co., The F.
Brady, T. H.
Central Electric Co
Klein & Sons, Mathias

TIME SWITCHES
Bissell Co., The F.
Hartford Time Switch Co.
Manhattan Electrical Supply Co.

TOOL STEEL
Jessop & Sons, Ltd., Wm.

TOOLS
Klein & Sons, Mathias

TRANSFORMERS
Allis-Chalmers Co.
Crocker-Wheeler Co.
Doubleday-Hill Electric Co.
Duncan Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
International Electric Meter Co.
Kuhlman Electric Co.
Moloney Electric Co.
New York & Ohio Co.
Thordarson Electric Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

TROLLEY WHEELS
Doubleday-Hill Electric Co.
Johns-Manville Co., H. W.

TRUCKS, STORAGE BATTERY AUTO
Westinghouse Machine Co.

TUBES
Fibre Conduit Co.

TURBINE GOVERNORS
Allis-Chalmers Co.
Lombard Water-Wheel Gov. Co.

TURBINES, STEAM
Allis-Chalmers Co.
General Electric Co.
Smith Co., S. Morgan
Westinghouse Machine Co.

TURBINES, WATER
Allis-Chalmers Co.
Leffel & Co., Jas.
Smith Co., S. Morgan

UNCOATED ARMATURE TAPES AND SLEEVINGS
Belden Mfg. Co.
Dunton Co., M. W.

VACUUM CLEANING MACHINERY
General Compressed Air & Vacuum Machinery Co.

VACUUM DRYING
Buffalo Fdy. & Machine Co.
Devine Co., J. P.

VARNISH, INSULATING
Massachusetts Chemical Co.
Standard Paint Co.

WATER-WHEELS
Allis-Chalmers Co.
Leffel & Co., Jas.

WATER-WHEEL GOVERNORS
Allis-Chalmers Co.
Woodward Governor Co.

WELDERS, ELECTRIC
Warren Electric Mfg. Co.

WINDERS, ELECTROMAGNET
Belden Mfg. Co.

WINDING MACHINERY
American Insulating Machinery Co.
New England Butt Co.

WIRE CONNECTORS
Belden Mfg. Co.
Dossert & Co.
Doubleday-Hill Electric Co.

WIRES AND CABLES
American Electrical Works
Atlantic Insulated Wire & Cable Co.
Belden Manufacturing Co.
Bishop Gutta Percha Co.
Bissell Co., The F.
Bridgeport Brass Co.
Brixey, W. R.
Central Electric Co.
Chicago Fuse Wire Mfg. Co.
Detroit Insulated Wire Co.
Dielectric Co. of America
Doubleday-Hill Electric Co.
Driver-Harris Wire Co.
Electric Cable Co.
General Electric Co.
Habirshaw Wire Co.
Hazard Mfg. Co.
Indiana Rubber & Insulated Wire Co.
Lawrence Electric Co., F. D.
Lowell Insulated Wire Co.
Marion Insulated Wire & Rubber Co.
Moore, Alford F.
National Conduit & Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The
Partrick, Carter & Wilkins Co.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Phosphor-Bronze Smelting Co., Ltd.
Roebling's Sons Co., John A.
Simplex Electrical Co.
Standard Underground Cable Co.
Waterbury Co.
Wesco Supply Co.
Western Electric Co
Wire & Telephone Co. of America

ELECTRICAL MECHANICAL CONSULTING

DIRECTORY OF ENGINEERS

CONTRACTORS SPECIAL INTERESTS

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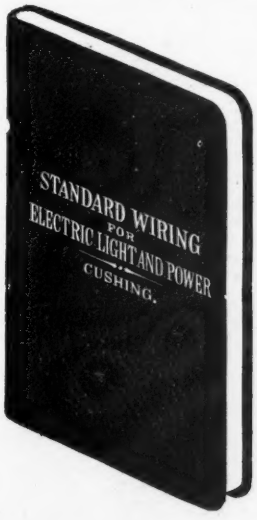

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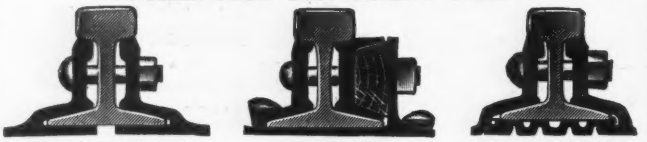

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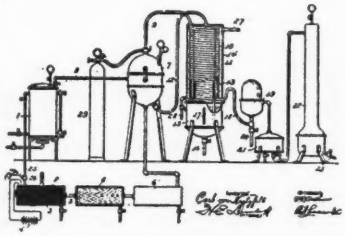

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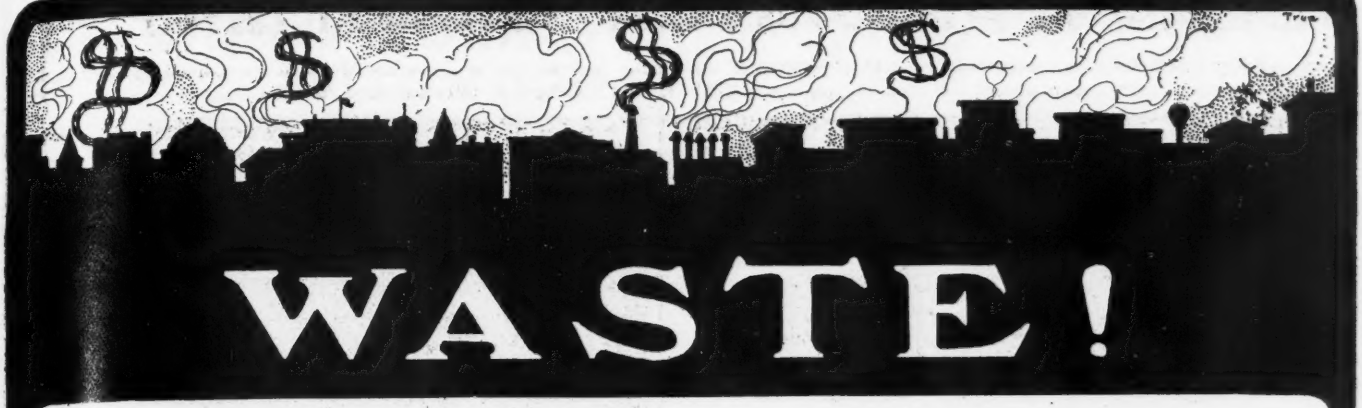

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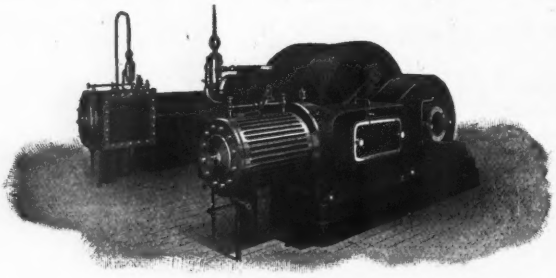

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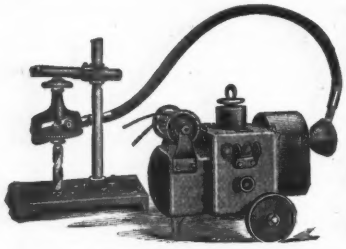

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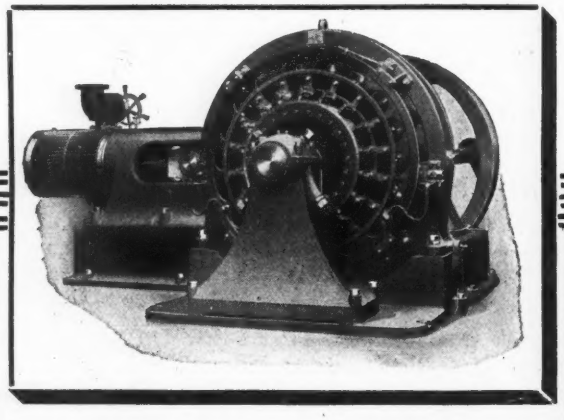

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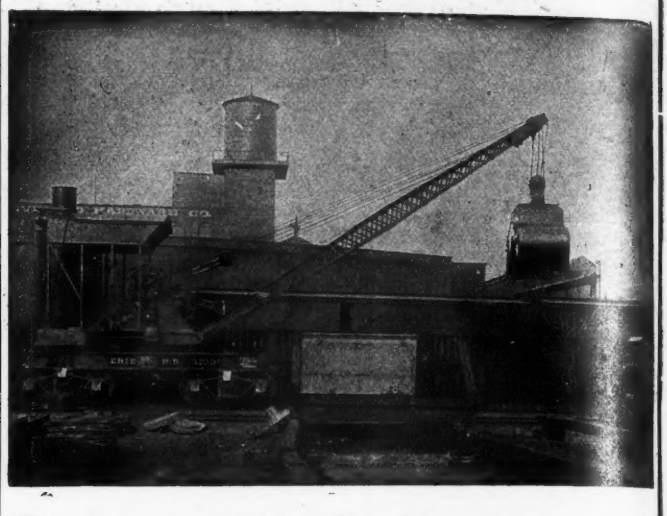

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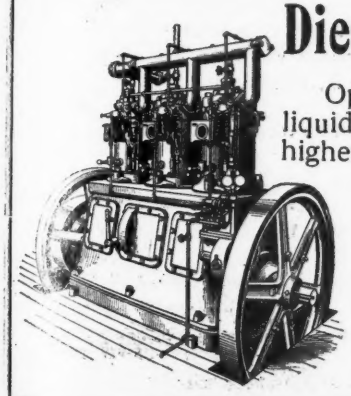

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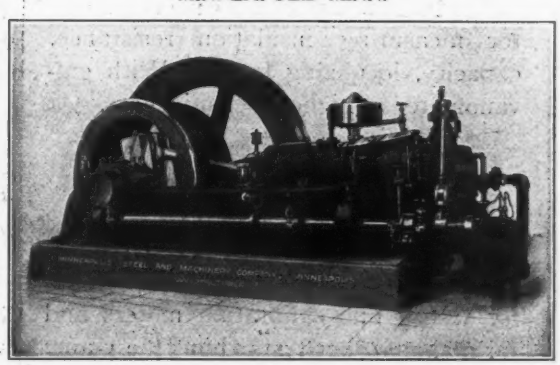

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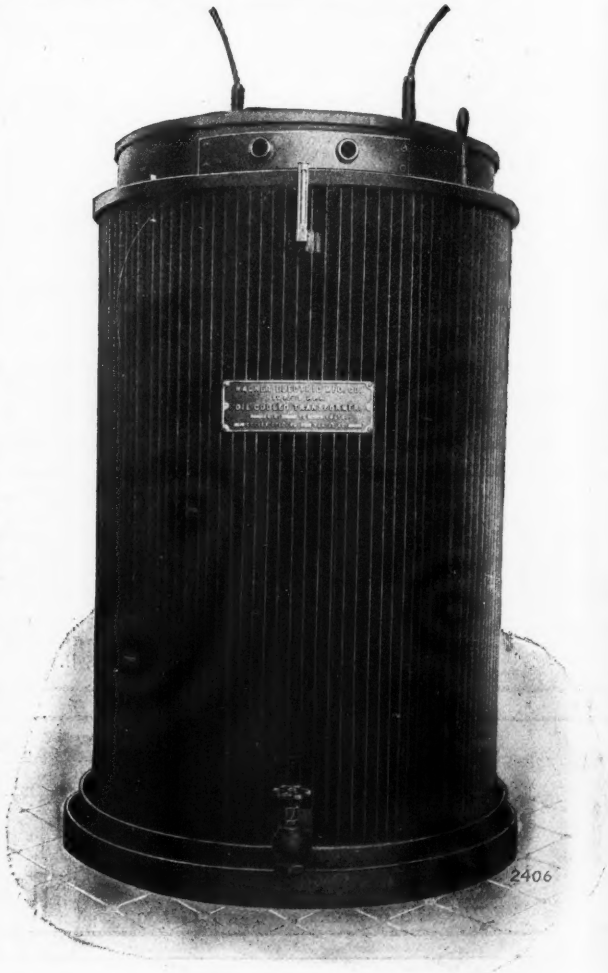


The Wagner Company invites opportunity to bid on transformers—any voltage and in units of from 6-10 k. w. to 5,000 k. w.

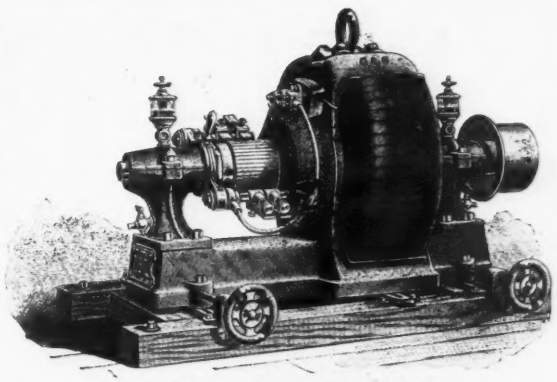
Please address the nearest office

Atlanta, Ga., Empire Bldg.
Boston, Mass., 110 State St.
Chicago, Ill., Marquette Bldg.
Cincinnati, Ohio, First National Bank Bldg.
Cleveland, Ohio, New England Bldg.
Denver, Colo., 1621 17th St.
Kansas City, Mo., Dwight Bldg.
Los Angeles, Cal., 326 S. Los Angeles St.
Minneapolis, Minn., Security Bank Bldg.
New York, N. Y., 50 Church St.
Philadelphia, Pa., Real Estate Trust Bldg.
Pittsburg, Pa., Farmers' Bank Bldg.
Portland, Ore., McKay Bldg.
St. Louis, Mo., 6400 Plymouth Av.
San Francisco, Cal., Balboa Bldg.
Seattle, Wash., Pacific Block
Sioux City, Ia., 515-517 5th St.
Montreal, Canada, Bell Telephone Bldg.

26 Years of Actual Experience
1883 ═══ 1909

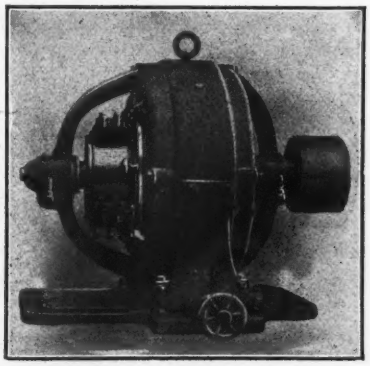
OUR MOTTO:

Don't Blame the Meter



C & C Bipolar Type Motor of 1889

Use an ECONOMICAL MOTOR and Cut Down Your Power Bills



C & C Multipolar Type Motor of 1908

THE C&C ELECTRIC CO.

Works and General Office: GARWOOD, N. J.

Branches: NEW YORK, 149 Broadway. BOSTON, H. A. HOWARD, 10 Post Office Square. PHILADELPHIA, 201 W. E. Trust Bldg.

AGENCIES IN ALL PRINCIPAL CITIES

TRIUMPH

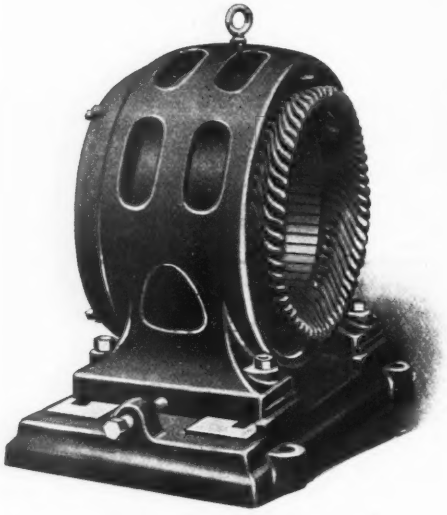
POLYPHASE INDUCTION MOTORS

Combine all the Essentials of a Good Motor,

Efficiency, Durability, Simplicity.

The highest efficiency is obtained by the careful selection of high grade material, iron of the highest permeability and copper of the highest conductivity. The extreme durability and rigid construction for which TRIUMPH MOTORS are noted is the result of correct design—the proportioning of parts to safely withstand the maximum strains to which they may be subjected. Non-essentials are eliminated and the materials used are employed to exceptional advantage, resulting in a machine, light, easily handled, requiring small space and inexpensive foundations for the supporting framework. In the TRIUMPH design rare simplicity has been obtained by reducing to a minimum the number of parts requiring attention, thereby making it safe that the machine be entrusted to unskilled employees, and insuring a ready accessibility for inspection, low depreciation and small cost for repairs.

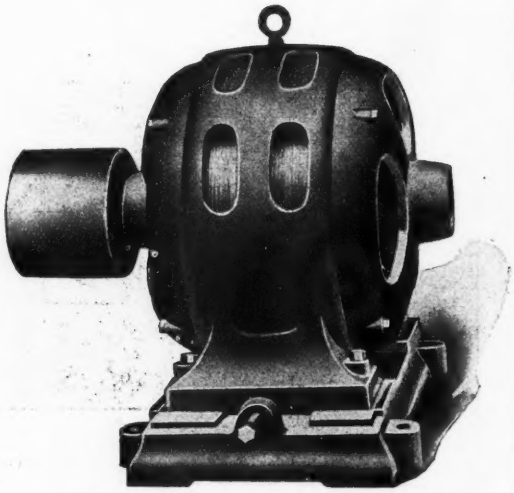
HIGHEST EFFICIENCY—COOLEST RUNNING.



STATOR.

Ample openings insure good ventilation, cool running. Long Service. Special non-aging core steel reduces core losses and increases efficiency.

Induction motors designed to withstand extremely heavy starting torques.



25 H. P. THREE-PHASE INDUCTION MOTOR.

Triumph Induction Motors Have Exceedingly High Power Factors.

The perfect combining of all the units that form the complete whole—every unit perfectly built of the best material—has given TRIUMPH MOTORS their pre-eminence in the electrical field.

Write for Bulletin W-321. Do it Now.

Triumph Electric Co.

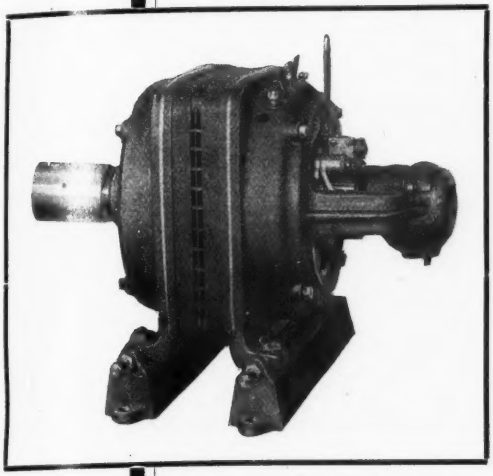
Cincinnati, Ohio, U. S. A.

New York, 1 Madison Ave. **Branches in all Large Cities.** **Chicago, Great Northern Bldg.**

KIMBLE VARIABLE-SPEED

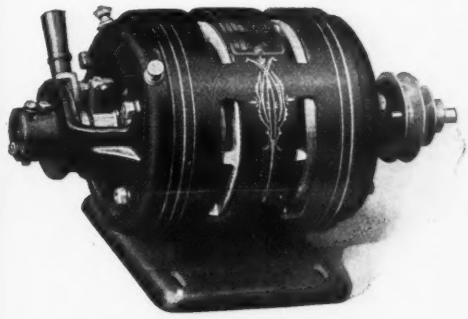
Single-Phase A. C. Motors

The first in the field, as originators of **Variable-Speed A. C. Motors,** we established a standard of excellence beyond the attainment of competitors and have maintained our initial pre-eminence by constant improvements based on the latest advances of scientific knowledge.

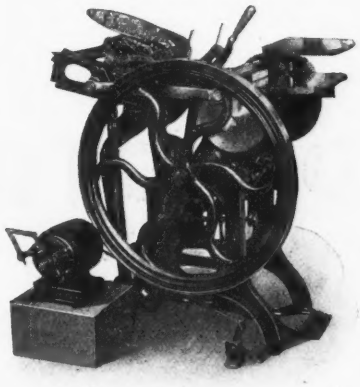


Variable-Speed and Reversible A. C. Power Motor. ½ h. p., $80.00; ¾ h. p., $95.00: 1 h. p., $105.00; 1½ h. p., $125.00.

Variable-Speed Alternating-Current Blower. Made in two sizes. Price of ⅛ h.p., $36.00; ¼ h. p., $60.00



Variable-Speed A. C. Power Motor. ⅛ h. p., $27.00; ¼ h. p., $50.00; ⅓ h. p., $60.00



Variable-Speed A. C. Printing Press Motor ¼ h. p., $52.00; ⅓ h. p., $60.00; ½ h. p., $85.00; ¾ h. p., $100.00; 1 h. p., $110.00; 1½ h. p., $130.00.

No Compensating Devices.

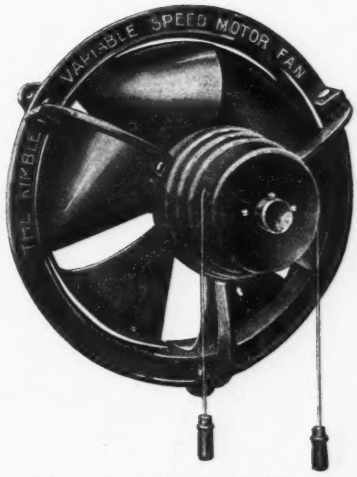
No Starting Coils.

No Burn-Outs.

The connecting of two wires gives you power where you want it, immediately.

These Motors are sold under a definite two years' guarantee—a guarantee that covers all essential points.

Anything More?



Variable-Speed A. C. Ventilating Fan. 18 inch, $65.00; 24 inch, $90.00

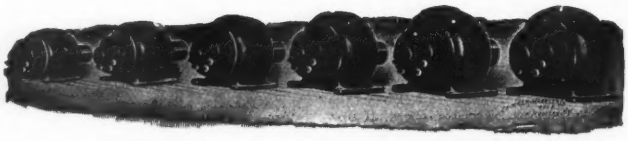
Write for detailed information—Catalogue A

KIMBLE ELECTRIC CO.

617 W. Adams Street CHICAGO

AMPERE AND CHICAGO

are the two main depots for **C-W** Motors.



Form L Direct-Current Motor
1-20 to 5 H. P.
See Bulletin 98-K.

Form Q Induction Motor
20 to 200 H. P.
See Bulletin 105-K.

Will you write or wire to us when you want motors out of *stock?*

CROCKER-WHEELER COMPANY

A. C. and D. C. Machinery of any capacity.

MAIN OFFICE: AMPERE, N. J.

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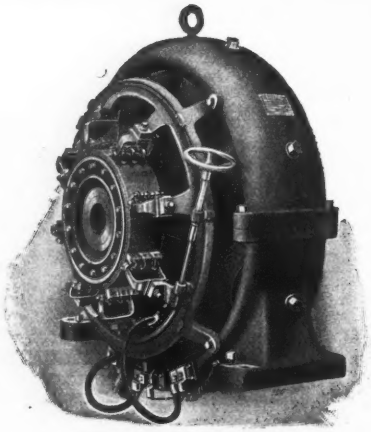
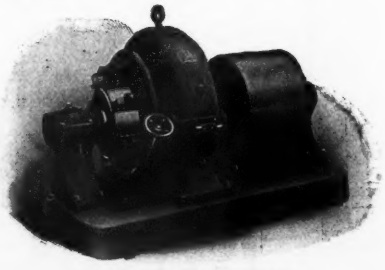
GENERATORS AND MOTORS

HIGH OVERLOAD CAPACITY
HIGH EFFICIENCY
LOW TEMPERATURE RISE



ENGINE-TYPE GENERATOR
Sizes to 350 K. W.

Send for Bulletin No. 151



THREE-BEARING MOTOR
Sizes to 500 H. P.

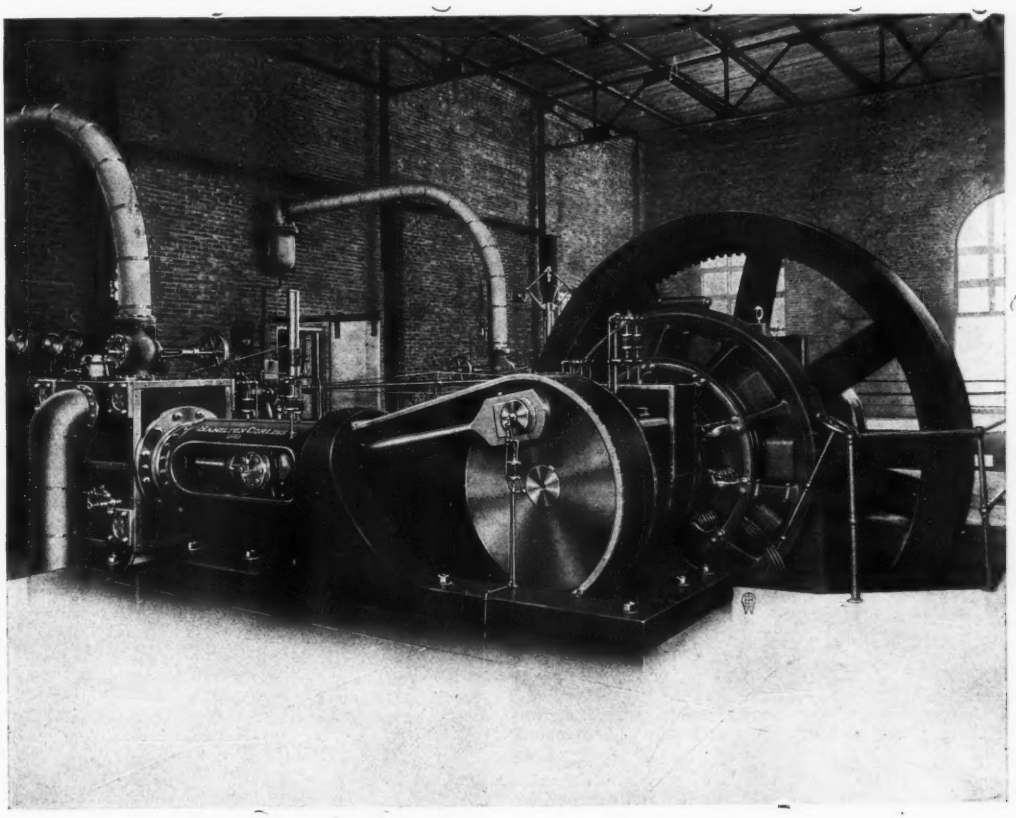
DIEHL MANUFACTURING CO., ELIZABETHPORT, NEW JERSEY

Branches: NEW YORK, PHILADELPHIA, BOSTON, CHICAGO, BALTIMORE

FORT WAYNE ELECTRIC WORKS
"WOOD" SYSTEMS

Before You Install Electrical Equipment of Any Kind

Let us tell you some facts about Fort Wayne apparatus. You can't be sure of the best until you know the merits of our machines.



Type MPL, 300 Kw. Direct-Current, Direct-Connected Generator

The Power Plant

Is the mainspring of your business, you can't afford a breakdown there—not even a chance of it. You know how essential it is to have a power plant that is absolutely reliable—you don't need to be told that, but we DO want you to know why we can make such strong guarantees on our apparatus.

Ask for Bulletin 1079B

We make both alternating and direct current motors, generators, arc lamps, switchboards.

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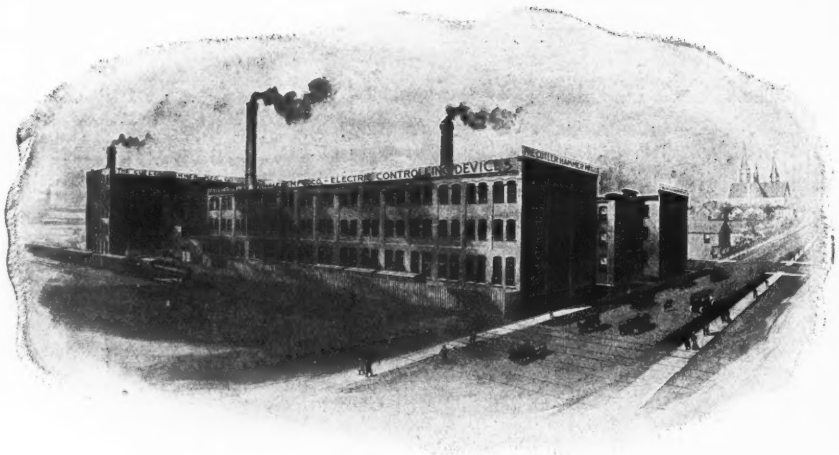
762

See our Exhibit at the Electrical Show, Chicago, January 16-30, 1909

CUTLER-HAMMER



Plant of the Cutler-Hammer Mfg. Co. (Milwaukee, Wis.)
Largest in the World Devoted Exclusively to the Manufacture of Electric Controlling Devices.

For sixteen years we have been MAKERS OF ELECTRIC CONTROLLING DEVICES. For sixteen years we have been designing and building every conceivable kind of device for controlling every imaginable sort of electrically operated apparatus. Much that we did not know in the beginning, we have learned by experience — the best of teachers — and that experience is at YOUR service if you have before you any problem involving electric control.

This means that at the cost of a two-cent stamp you can command the services of experts who have been solving electrical control problems for years.

It means that by merely addressing a letter to our nearest office you can secure, in a few days, information that might otherwise cost weeks of work to obtain.

Oftentimes we are able to save our correspondents time and money by indicating how slight changes in some of our standard controllers will give exactly the result desired and so render unnecessary the design and construction of special apparatus.

If you already know exactly what you want to do and how you wish to do it, we shall be pleased to quote to your specifications. If you merely know the result you wish to accomplish without having any very definite idea of the apparatus required, we shall be glad to advise you as to the method of control best suited to your particular case and to submit estimate covering cost of necessary equipment.

OUR BUSINESS can be described in five words: **Makers of Electric Controlling Devices.**

But—

Did you ever stop to consider what these five words mean?

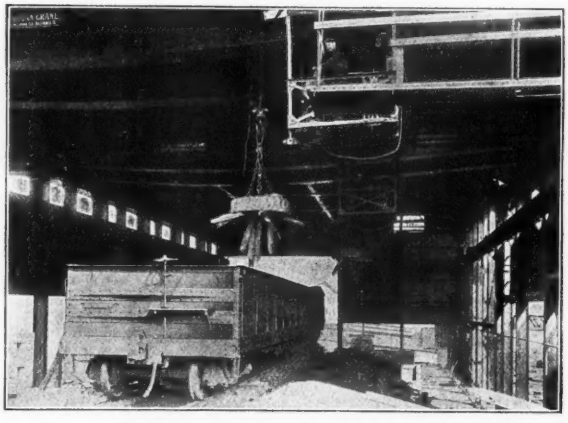
They mean the manufacture of switches for the control of a single lamp circuit, and they mean the building of dimmers that control the myriad lights of an Opera House or a Hippodrome.

They mean the design of controllers to govern the revolutions of a washing machine, or of the ponderous turrets of a battleship.

They mean the making of float switches that start and stop the motor pumping a few hundred gallons of water to the top of a building, and they mean the design and construction of the controlling equipment for a pumping plant that supplies a hundred thousand homes.

They mean speed regulators for sewing machines and boring mills; they mean controllers for dumb-waiters, passenger elevators and skip hoists; they mean a little five-button starting box for the motor operating an organ blower in the village church, and they mean systems of remote control for steel mills, ore docks and mines.

They mean, in short, a business that brings us in contact with every other business in which electricity is used.



Unloading Pig Iron with Cutler-Hammer Lifting Magnet.
This Photograph Taken at the Works of the Youngstown Sheet and Tube Company, Shows Crane Operator Unloading Pig Iron with a Cutler-Hammer Lifting Magnet, at the rate of 100 Tons per Hour.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK OFFICE: Hudson Terminal (50 Church St.) BOSTON OFFICE: 176 Federal Street.
CHICAGO OFFICE: Monadnock Block. PITTSBURG OFFICE: Farmers' Bank Building.
PACIFIC COAST AGENTS: Otis & Squires, 111 New Montgomery Street, SAN FRANCISCO.

CUTLER-HAMMER

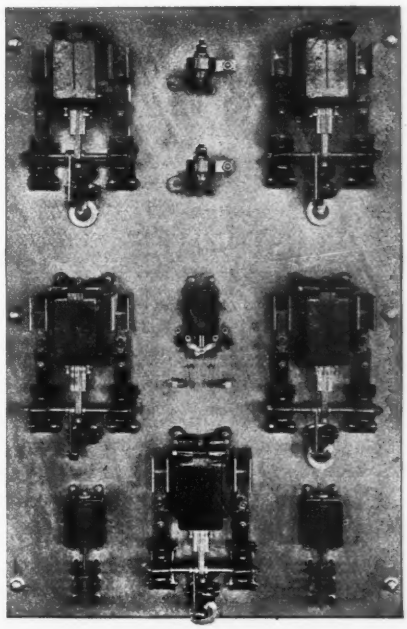
Turret of Battleship Equipped with Cutler-Hammer Turret Turning Gear.

Navy Apparatus

For many years we have paid particular attention to the design and manufacture of electric controlling devices conforming to Navy Department specifications. We have standardized the types of controllers most frequently called for, such as motor starters and speed regulators, fan regulating panels, machine-tool controllers for Navy Yard use, etc., and in addition to these we are prepared to quote on any kind of special controlling apparatus called for by the Navy Department. Cutler-Hammer controlling devices are in use in every navy yard in the United States and on nearly all of the newer battleships. We endeavor to keep in close touch with navy department requirements and are always glad to give the benefit of our experience to those who contemplate bidding on Government contracts.

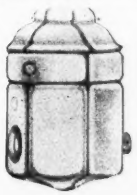
Alternating-Current Controllers

Anticipating the rapid development of alternating-current transmission, we long ago turned our attention to the design of alternating-current controlling devices. The apparatus constructed from these designs has been subjected not merely to factory tests, but has been widely installed and its operation studied under actual service conditions. As a result of this opportunity to observe the controllers in operation and to correct such defects as developed under long-continued and severe usage, we have now a line of alternating-current controlling devices that long since emerged from the experimental stage. These include motor starters and speed regulators of various kinds, elevator controllers, crane controllers, fan regulators, pump starters, etc. Let us know in what class of apparatus you are interested and we will send descriptive Bulletins.



Cutler-Hammer Controller for Alternating-Current Motor, Operating Centrifugal Pump.

Apparatus for the remote control of alternating-current motors is one of our specialties. One of the widest fields of application for these automatic controllers is their use in connection with motor-driven pumps. The illustration printed above shows a self-starter designed for use with a squirrel-cage motor operating a centrifugal pump.



Push-Button Pendent Switch

Push-Button Lamp Socket.

Push-Button Specialties

The switches and lamp socket embraced in this new line of approved specialties possess a number of advantages that should commend them to the trade and to all users of such devices. Not the least of these advantages is the fact that being made of porcelain they will not tarnish like ordinary metal switches and sockets, nor is the user subjected to the risk of accidental shock while handling them, since all current-carrying parts are effectually insulated by the outer covering of porcelain. The mechanism — the simplest ever devised—consists of only three moving parts. Descriptive booklet on request.

Particular attention is called to the TWO-CIRCUIT switch and to the push-button lamp socket, ideal for use with tungsten lamps, since it operates without jarring the delicate filament.

Push-Button Surface Switch with Label Holder.

Two-Circuit Pendent Switch.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

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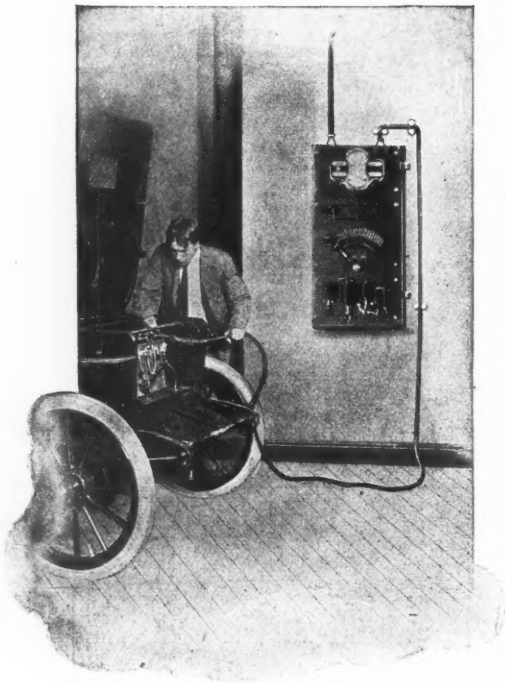
CUTLER-HAMMER



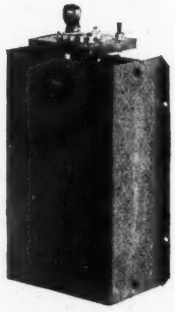
Cutler-Hammer Battery-Charging Rheostat.

Battery-Charging Rheostats

We have recently published a 24-page booklet descriptive of our line of Battery-Charging Rheostats.

This line includes six distinct types of charging rheostats, each of which is made in thirteen different capacities affording a wide range for selecting the piece of apparatus best suited to each particular case. The booklet also illustrates and describes rheostats designed for charging ignition batteries.

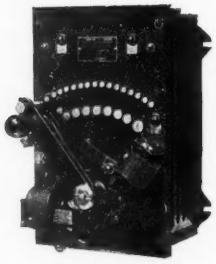
We shall be glad to send a copy of this booklet to anyone interested in the subject of Battery-Charging Rheostats.



Rheostat for Charging Ignition Batteries.

Motor Starters and Speed Regulators

We carry constantly in stock for immediate shipment, 6 000 speed regulators and starting boxes of all types and sizes. No other manufacturer of controlling apparatus has standardized such an infinite variety of starting rheostats and speed regulators as is embraced in the Cutler-Hammer line. Sizes range from little one-quarter horsepower starters and speed regulators up to panels suitable for use with motors of 1,500 H. P. or more. When writing for information state voltage and horsepower of motor, and if rheostat is to be installed in a damp location specify MOISTURE PROOF resistance.



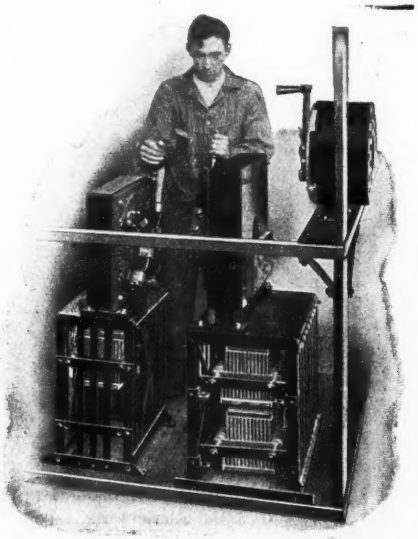
Combined Motor Starter and Speed Regulator.

Crane and Hoist Controllers

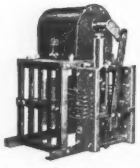
There is probably no class of service in which electrical apparatus is subjected to harder usage than in a steel mill. Our Pittsburg Office, located in the heart of the world's greatest steel-producing territory, is in close touch with the requirements of the steel mills, and Cutler-Hammer crane controllers are built to meet those requirements. They are of exceptionally rugged construction and all parts subject to wear are made renewable and easy of access.

Standard crane controllers are designed for intermittent duty on direct-current circuits, but we are prepared to furnish, also, special controllers for continuous service—slow-speed controllers for raising flasks in foundries, and similar duty—and crane controllers designed for use on alternating-current circuits.

Our illustrated booklet on Crane Controllers is free on request.



Crane Cab Equipped with Cutler-Hammer Control.



Elevator Controllers

If interested in this subject send for Bulletins 51, 52, 53, 54, 56 and 57, covering the most complete line of direct and alternating current elevator controllers on the market. We make, also, self-starters, belt-switches, reversing switches, limit switches, etc.

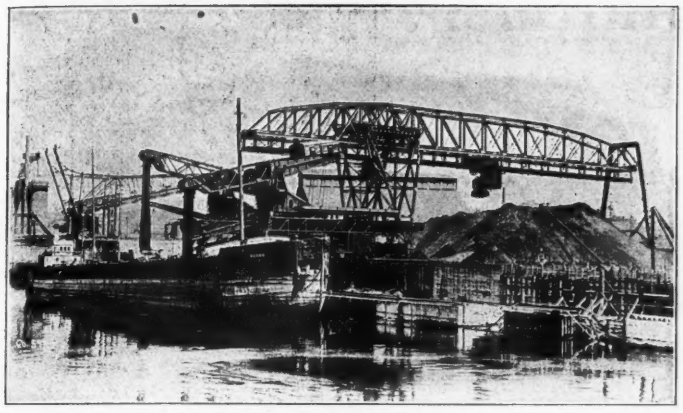
Printing-Press Controllers

The Cutler-Hammer line of printing-press controllers includes speed regulators for both platen and cylinder presses. We are prepared to furnish, also, controllers for ruling machines, wire stitchers, folders, perforators and other machines used in printinng offices and binderies.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK OFFICE: Hudson Terminal (50 Church St.) BOSTON OFFICE: 176 Federal Street.
CHICAGO OFFICE: Monadnock Block. PITTSBURG OFFICE: Farmers' Bank Building.
PACIFIC COAST AGENTS: Otis & Squires, 111 New Montgomery Street, SAN FRANCISCO.

CUTLER-HAMMER



Unloading Ore on the Great Lakes.
Hulett Ore Unloaders Equipped with Cutler-Hammer Control.

Remote-Control Apparatus

Only those who have kept in close touch with recent developments in remote-control apparatus fully realize the great progress that has been made in this branch of the electrical industry within the past few years.

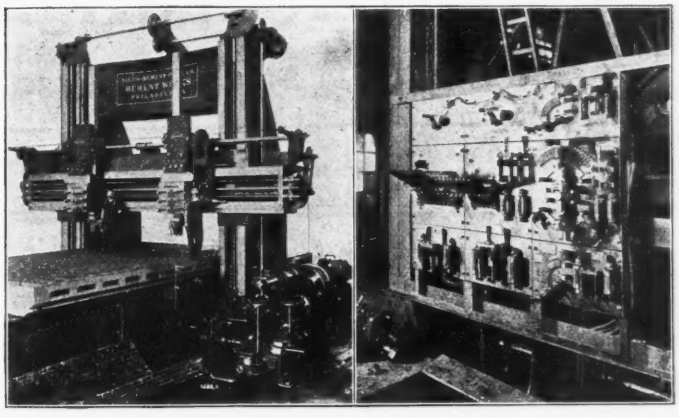
The applications of systems of automatic control are numberless and in many cases their adoption results in economies impossible by the use of manually operated controllers. By means of automatic devices certain operations, or a series of operations, can be repeated in regular cycles without requiring the presence of an attendant. Moreover, it is possible by the use of automatic apparatus to positively insure the motor and the machinery it operates against damage due to too sudden starting or stopping, abnormal current conditions, etc.

It may be that the remedy for YOUR troubles is —automatic control.

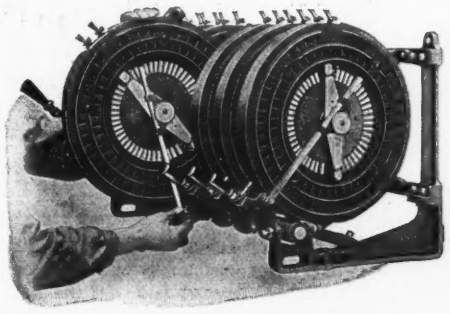
Machine-Tool Controllers

The fact that the leading motor manufacturers and machine-tool manufacturers of the country have for years been the largest purchasers of Cutler-Hammer machine-tool controllers would seem to indicate that this line of controllers meets more fully than any other, the various requirements of machine-tool speed regulation. This fact is the more significant when it is remembered that there are cheaper controllers on the market—controllers on which the motor manufacturer or machine-tool manufacturer could make a larger profit if he were willing to furnish with his own apparatus any controller but the best.

If interested in this subject send for our Bulletins on Machine-Tool Controllers.



Largest Planer Ever Built. Controlled by a Cutler-Hammer Panel.



Cutler-Hammer "Simplicity" Theater Dimmer.

"Simplicity" Theater Dimmers

A few months hence the theatrical season will be ending and managers will be planning improvements for the reopening in the fall.

Now is a good time to send for our booklet "Stage Lighting," a 48-page pamphlet containing some twoscore illustrations and diagrams, including cuts of dimmers installed in the Cleveland Hippodrome, Brooklyn Academy of Music, Forrest Theater, Philadelphia; McVicker's Theater, Chicago; Garrick Theater, St. Louis, and many other well-known play houses. In New York city and Chicago—the two great theatrical centers—more than 80 per cent. of the theaters have already installed Cutler-Hammer dimmers. The same booklet describes and illustrates single-plate and double-plate dimmers for churches, lodge rooms etc.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK OFFICE: Hudson Terminal (50 Church St.) BOSTON OFFICE: 176 Federal Street.
CHICAGO OFFICE: Monadnock Block. PITTSBURG OFFICE: Farmers' Bank Building.
PACIFIC COAST AGENTS: Otis & Squires, 111 New Montgomery Street, SAN FRANCISCO.

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The Flat Rate Controller?

IT'S PROFITABLE

And no attention required when once installed.

You sell current to your consumer for a lump sum.

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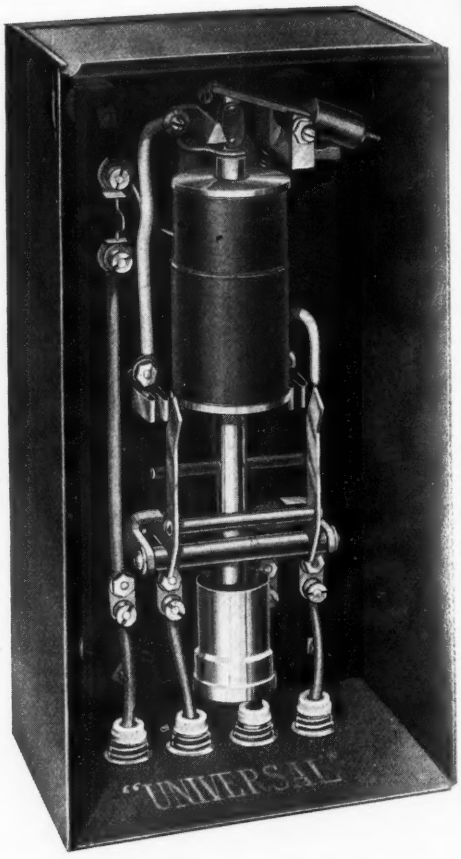
Can be obtained from CENTRAL ELECTRIC CO.

The Universal Mfg. Co.

206 E. Illinois Street, Chicago



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Are the Result of 14 Years' Specializing in ONE Field:

AUTOMATIC Motor Control

15 H.P., 220 V., Type " " For 3 Phase Slip-Rin

We have the most complete and best developed line of Automatic Motor Control, for both Direct and Alternating Current, on the market.

Our standard apparatus includes Self-Starters for Pumps, Air Compressors, Vacuum Cleaning Plants, and all forms of remote control; Elevator Controllers for all kinds of service, and Magnet Switches for remote control of lighting circuits.

We also Manufacture Special Apparatus to Meet Special Requirements.

5 H.P., 220 V., Type "AA" Starter Direct Current

If you want to control a motor automatically or from a distance write us and get the benefit of our experience.

Catalog Sent on Request

J. L. Schureman Co.

70-86 West Jackson Boulevard Chicago

New York Sales Office: 95 Liberty St. Philadelphia Sales Office: 1328 Chestnut St.

THE CUTTER CO.

Had a satisfactory year, but it would be idle to pretend that it was a prosperous one. The circuit-breaker does not bear a charmed life. Used as it is by the largest interests in the country in every line, we are dependent upon the general prosperity of the country, but from facts and figures reported we have more than held our own.

By this we mean that the I-T-E Circuit-Breaker stands in higher favor today than it did a year ago. More engineers have come to specify it when they want the best, and more than ever before it is used to the exclusion of cheaper and less efficient types.

During the depression, from which we are emerging, the wise man has improved his time by tuning up his plant so as to be ready for the rush of business which is sure to come. Never before have we replaced with I-T-E Circuit-Breakers so many other breakers which the test of actual service demonstrated to be useless. Several important instances of such replacements are well known and will at once occur to you.

Of the new work going we have had more than our share and we got it on merit alone. The largest companies in the country, in every line, are the most enthusiastic users of our apparatus.

Our long contention that the best is the cheapest is again fully justified. The man whose responsibility does not cease when the plant is first turned over is the man whose endorsement we want: and we get it.

To the fact that we devoted practically our entire attention to the perfection of one piece of apparatus, namely, the I-T-E Circuit-Breaker, is due the favorable reputation which this piece of apparatus enjoys.

In original work we have not been idle. During the coming year we shall place upon the market a number of new and important developments in circuit-breaker practice which cannot fail to be of interest and value.

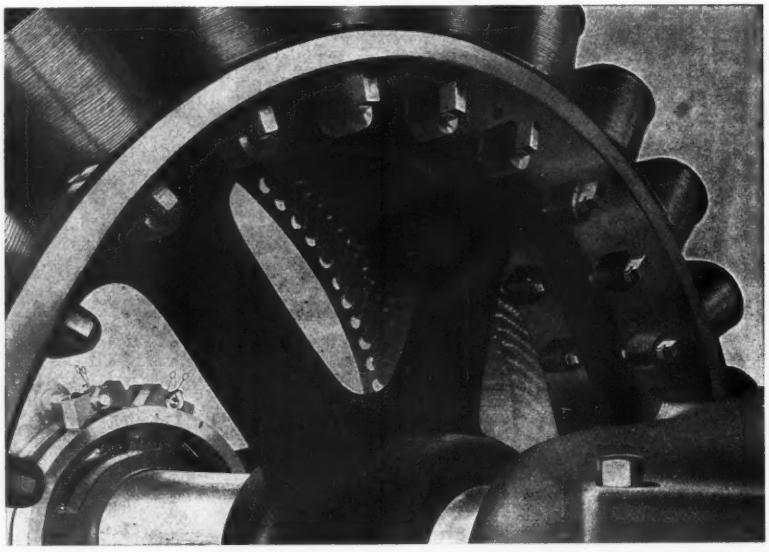
The direction of our Engineering Department continues with Mr. Wm. M. Scott, whose reputation as an engineer is inseparable from the piece of apparatus to which he has devoted so many years.

We are indebted to our agents for their unremitting energy and attention, to which in no small measure our success is due. Among them, to Mr. H. F. Darby, who during the year assumed charge of our Chicago Office at 636 Marquette Bldg., Chicago; to Mr. W. C. Jessup, who for some years past has represented us at 120 Liberty Street, New York City, and to Mr. H. W. MacVaugh, who continues to represent us at 1122 Park Bldg., Pittsburg, our thanks are especially due.

We take this opportunity of wishing our customers a Happy and Prosperous New Year.

THE CUTTER COMPANY

Circuit-Breaker Engineers and Manufacturers PHILADELPHIA



Alternating Current Revolving Field Generators

1,000 K. W. and under

Illustration shows detail of Pole Anchors and Collector Rings

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MINNEAPOLIS, MINNESOTA, U. S. A.

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RICHMOND INDUCTION MOTOR

The Richmond Electric Company

Richmond, Va.

Emerson Small Motors

1-40 to 1-2-h. p., single-phase; 1-20 to 2-h. p., direct-current, multiphase motors up to 1 h. p. A hundred different types regularly in stock. We make motors for every service. Special types developed. Motors for sewing machines, washing machines, motor-driven forge blowers exhausters, motor lathes. Write for Bulletins. Prices to the Trade only.

THE EMERSON ELECTRIC MFG. COMPANY

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Eastern Office: 50 Church Street, New York City

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MANUFACTURERS OF

SINGLE-PHASE SELF-STARTING

Motors and Ceiling Fans

Olive and 19th Streets, St. Louis, Mo.

NOISELESS GEARING

NEW PROCESS NOISELESS PINIONS

meshed with your metal gears will stop that ringing, grinding noise wherever gear drives are used. Let us send you a list of prominent concerns now using them.

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The New Process Raw Hide Co., Syracuse, N. Y.

Electrical Supplies Backed By This Trade Mark Can Be Depended Upon

Victor Flaming Arc Lamps

Victor Flaming Arc Lamp

The Western Electric Company has eliminated all the annoyance and expense of adjusting complicated feed regulating mechanism in Flaming Arc Lamps by entirely eliminating the mechanism. In the Victor, the burning of the carbons automatically regulates the feed.

For illuminating large interiors or free spaces, the Victor Flaming Arc Lamp stands unequalled. It gives 3000 c. p. with a power consumption of only 500 watts. Lamps operate on either A.C. or D.C. Circuits.

Our special bulletin No. 330 gives a complete description of the lamp, points out different applications to which it is adapted and gives tables of data that prove the Victor

"The Sun's Chief Competitor"

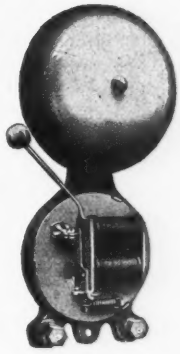
The "Hawthorn" Bell

The "Hawthorn" is sold under a guarantee to be the most reliable battery bell and also to have the lowest current consumption.

The low current consumption is due to the magnets being wound with our special black enameled wire. Since this insulation takes up much less space than cotton or silk, it is possible to use more turns in the same winding space, with the result that less current is required.

You may not know it, but if you are looking for the best bell on the market, you are looking for the "Hawthorn."

Full Information Given in the "Hawthorn" Folder



"Hawthorn" Bell with cover removed

Black Enameled Wire

Black Enameled Wire

This is a special product of the Western Electric Company, and for certain purposes is rapidly taking the place of all other magnet wires. The enamel insulation is an elastic, yet resistant and firmly adhering film which is applied to the wire.

As compared to silk and cotton insulated wire, black enameled wire has high insulation strength, requires a small amount of winding space and is much less affected by high temperatures or excessive moisture.

Our booklet No. 355 gives facts that will surprise and deeply interest you It explains why many engineers spec ify Black Enameled Wire always.

In YOUR Order Specify Black Enameled

Spark Coils

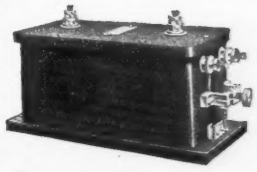
The chief factor in the marked superiority of Western Electric Spark Coils is the workmanship. The construction of the vibrator is such that it will give more sparks per minute than any other type.

The current consumption is lower than that of any other spark coil. It saves in the battery expense. If you own a gas or gasoline engine or an automobile, you are interested.

Our bulletin No. 341 gives detailed information. Read it and you will then understand *why* these spark coils give such superior service.

If you have not heard of our synchronized ignition system—write to us at once.

Secondaries Wound with Black Enameled Wire



Jump Spark Coil Gas Engine Type

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Manufacturers and Suppliers of all Apparatus and Equipment used in the Construction, Operation and Maintenance of Telephone Plants

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SERIES
REPULSION
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TYPE S

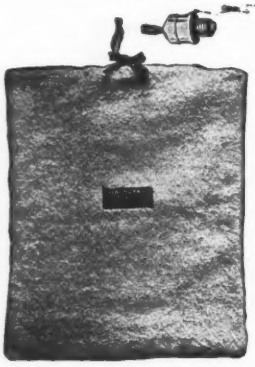
SINGLE-PHASE MOTORS

Self Starting—Low Starting Current—High Starting Torque
Interchangeable Voltage Connections

THE MECHANICAL APPLIANCE CO.
MILWAUKEE, WISCONSIN

Write for Type S Bulletin

SIMPLEX QUALITY



MANY people use an Electric Heating Pad practically every night through the winter to warm up the bedclothes before retiring. Then too, the cold, wet season aggravates ills, like neuralgia, that the heating pad does so much to relieve. Altogether, the time is now at hand when these articles can be most readily introduced. The stations that begin early will get the revenue from them all winter. Remember, Simplex Pads have given the best satisfaction for years. Write for terms.

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PASSBURG
Vacuum Drying and
Impregnating Apparatus

FOR
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FIELD and ARMATURE COILS,
ELECTRIC CABLES, Etc.

Absolute Dryness—No Overheating
No Fire Hazard—Operative Economy
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All Types All Sizes

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ELECTRICAL REVIEW PUB. CO.
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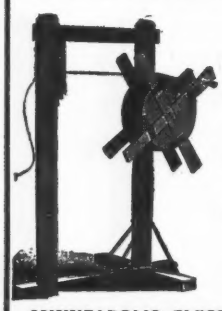
ONE DOLLAR EACH.

WIRE MEASURING MACHINE



A great convenience and time saver.

Reels wire into a neat coil and shows number of feet.

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MINNEAPOLIS ELECTRIC AND CONSTRUCTION CO.
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We Buy Old Belts or Scraps
ANY SIZE OR CONDITION
We Clean, Repair and Renew Old Belts.
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SAVE MONEY IN BELTING

QUALITY is remembered after PRICE is forgotten—we stick to selling Sable Belting because **a Sable Belt will transmit 25 to 33 per cent more power than any oak tanned belt.**

To prove it we will send one on 30 days' trial. If it is not all we claim, it may be returned at our expense. All shoes LOOK alike, but you still buy a $5.00 shoe although there are hundreds of brands of $3.00 shoes. Why? *Send for Booklet No. 42.*

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PROGRAM CLOCKS

are a great modern convenience in schools, colleges and other large buildings where automatic signals are desired. By their use any number of different bells in any number of different rooms may be rung at any time desired during the day.

ALSO 60-DAY, ELECTRIC WATCHMAN'S, AND FRYING-PAN CLOCKS. Send for Catalogue No. 207.

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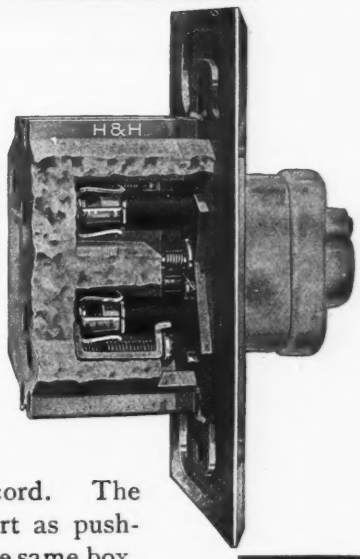
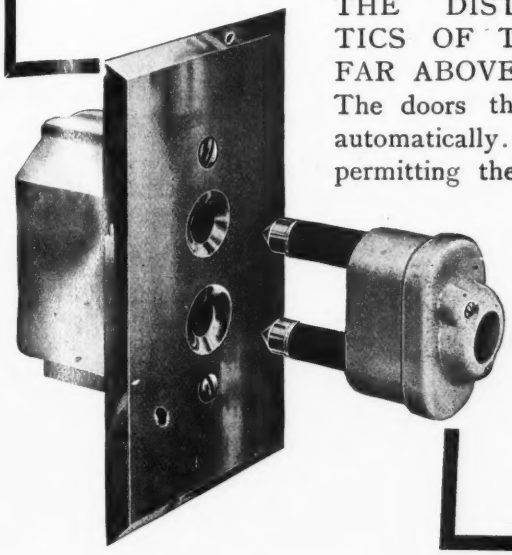
"H & H" FLUSH RECEPTACLE

IS AN EVOLUTION OF NEW IDEAS AND EXEMPLIFIES THE PROGRESSIVE SPIRIT OF THE AGE.





THE DISTINGUISHING CHARACTERISTICS OF THIS RECEPTACLE PLACE IT FAR ABOVE ANY OTHER MADE

The doors through which the plugs pass operate automatically. The plug has a 13-32-inch notch, permitting the use of No. 16 new code portable cord. The screw-holes are the same distance apart as push-switches, and the receptacle will fit in the same box.

Write for full information and prices. Catalogue "F" shows full line.

THE HART AND HEGEMAN MFG. CO.

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(1)

MICA PRICES REDUCED

Compare the quality of our Manufactured Mica with what you have been receiving from our competitors

WHY PAY FANCY PRICES?

CHICAGO MICA CO.

VALPARAISO, INDIANA

YOU MUST ENLARGE

your plant. Your switchboard is full, your cable capacity is exhausted. New subscribers are clamoring for service. You must buy more equipment.

DON'T BUY BOTH

central office equipment and cable. It's no longer necessary, now that we have perfected our multi-office plan of operation. Put your equipment where your subscribers are and save cable. A Keith unit district station will serve 100 or 200 subscribers over 20 to 40 cable pairs on

EITHER MANUAL OR AUTOMATIC PLANTS

that is, you can operate "semi-automatically" or automatically, just as you choose. The district station is completely supervised from the central office. You can add district stations to your system when and where you please, thereby buying

AN AUTOMATIC PLANT IN INSTALLMENTS

as you need and can afford it. You can buy a new district station every three or six months out of your income. You can operate these with manual telephones, then change to automatic, and thus gradually construct an all automatic plant. Write us for details.

Our Automatic System has been adopted in the following cities:

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Auburn, N. Y.	Hopkinsville, Ky.	Rochester, Pa.
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Beaver Falls, Pa.	Jonesboro, Ark.	San Diego, Cal.
Bellingham, Wash.	Kenton, Ohio.	San Francisco, Cal.
Berkeley, Cal.	Lake Benton, Minn.	Santa Monica, Cal.
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Butte, Mont.	Lewiston, Me.	Sioux City, Iowa.
Cadillac, Mich.	Lincoln, Neb.	South Bend, Ind.
Champaign, Ill.	Los Angeles, Cal.	Spokane, Wash.
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Be sure to see our exhibit at the International Independent Telephone Convention, Rooms 614-16, Auditorium Hotel, December 1st, 2nd and 3rd, 1908.

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Kellogg Intercommunicating Telephones

Are Giving Universal Satisfaction

IF you are interested in comparing the best Push-button Automatic Intercommunicating Telephones, ask for our Bulletin No 39-L.

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Are Now 50c Per Month

In the OFFICE they save Time, Energy and Money.
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and are Ideal as

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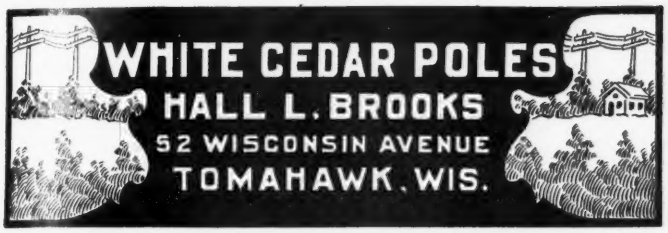

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C. H. WORCESTER CO.
TRIBUNE BLDG. CHICAGO.

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THE BEST TO BE HAD

That's the phrase that tells the whole story about

BISSELL Idaho and Michigan **Cedar Poles**

Get the prices. You'll find them right, too.

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WHITE CEDAR POLES

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A LARGE STOCK OF STRICTLY HIGH GRADE POLES

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New Shell Type Distributing Transformer

Type "S"

Low core loss.
Low exciting current.
Low copper loss.
Low load losses in the copper.
Good regulations at all power-factors.
Ample overload capacity.

Made in 16 Capacities:

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Primary: 1100-2200 Volts
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Type "S"

Low temperature rise of the windings.
Absence of hot spots in the windings.
High insulation strength.
Good mechanical construction.
Low weights. Small overall dimensions.

Circular No. 1157 gives full information

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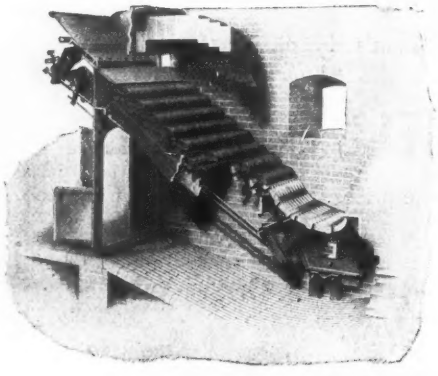
Canada: Canadian Westinghouse Co., Ltd., Hamilton, Ontario
Mexico: G. & O. Braniff & Co., City of Mexico

New Model Roney Stoker



The New Grate Bar

Eight feet of cooling surface for every square foot exposed to the fire.
Parts exposed to fire are small, inexpensive and easily renewed.
No bolts or screws used in assembling the parts.
More liberal air space, therefore burns more coal per square foot.
Sifting of fine coal prevented by side-ribs on bar sections above fire zone.

Ask for "New Model Roney" Folder 4004

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Steam Turbines, Steam Engines, Gas Engines, Gas Producers, Storage Batteries and the Roney Stoker
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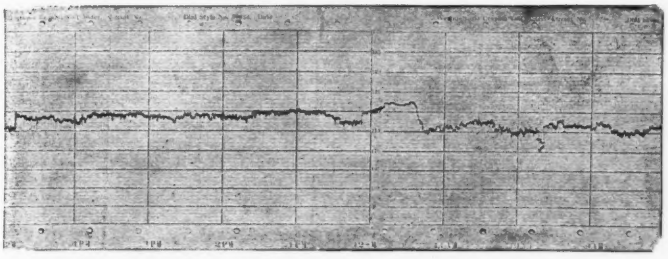
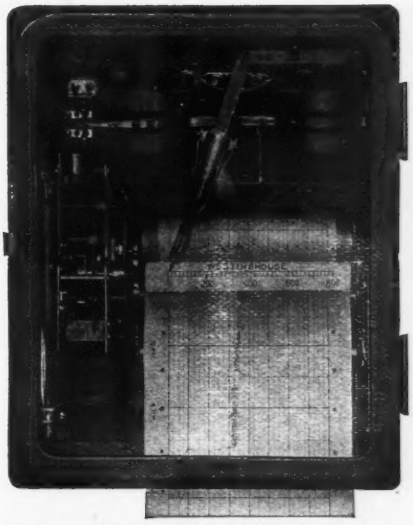
Graphic Meters



Their "record" is perfect in more ways than one.



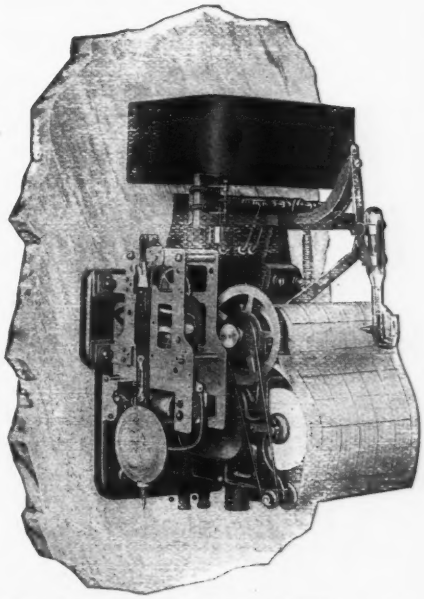
Recording Wattmeter for Alternating Current

Relay Type

Some Advantages:

Enormous torque of pen-driving mechanism.
Relay circuit supplies the power, not the meter transformers, as in direct-acting meters.
Meter element takes less power than indicating meters.
Contacts require even less attention than those of voltage regulators.
Absolutely dead beat; never overshooting the mark; no pen friction.
Meter element a complete Kelvin balance, free from all temperature, frequency or other errors. Unaffected by stray field-astatic.
Pen will operate for two months without renewal of ink. Paper is a continuous roll for two-month record.
Self-winding clock, requiring no attention, therefore meter may be sealed up and left in isolated localities without attention for two months.
Sensibility may be adjusted to record the slightest variation in load or to make an average curve.
Operates from transformers or shunts already installed for indicating meters.
By means of master clocks, or Western Union time service and synchronizing attachment, all meters on a system may be kept in absolute unison.
Speed can be changed to 4 or 8 inches per hour, in a few seconds. Records on thin paper, permitting making blue prints.

D. C. Ammeters, Speed Recorders and Wattmeters of any maximum capacity. A. C., D. C. Voltmeters, A. C. Ammeters, Wattmeters, Frequency Meters, Power-factor Meters.



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Specialists in
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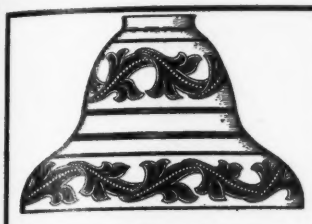

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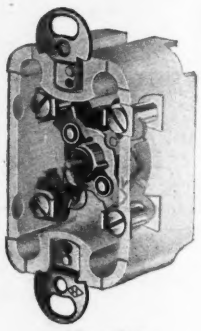

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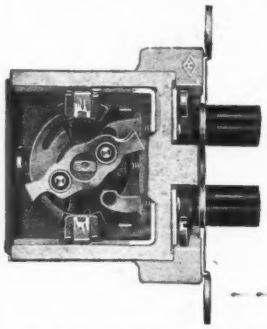

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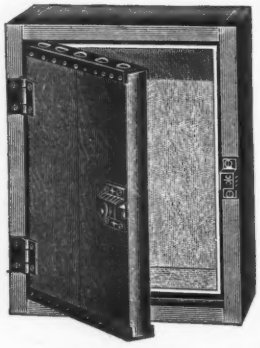

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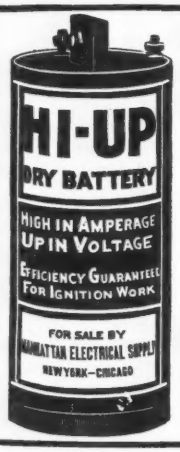

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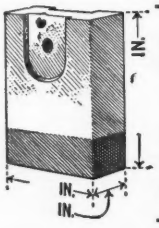

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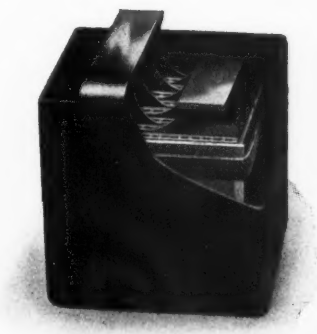

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and **The National Battery Company of New York**

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The present factory facilities have been greatly increased and more general and extensive stocks of material will now be found at the district depots and storerooms. The district offices, agencies, etc., have been increased in number. These extensive facilities insure prompt attention to all inquiries for apparatus, material or emergency advice and also enable the Company to effect rapid repairs and replacements. It is thus possible and it is the intention to keep in personal and immediate touch with all customers and users of the apparatus manufactured by this Company, alleviating costly and annoying delays.

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The engineering forces thus brought together will be at the disposal of Railroad Companies, Central Stations and users of storage batteries in general.

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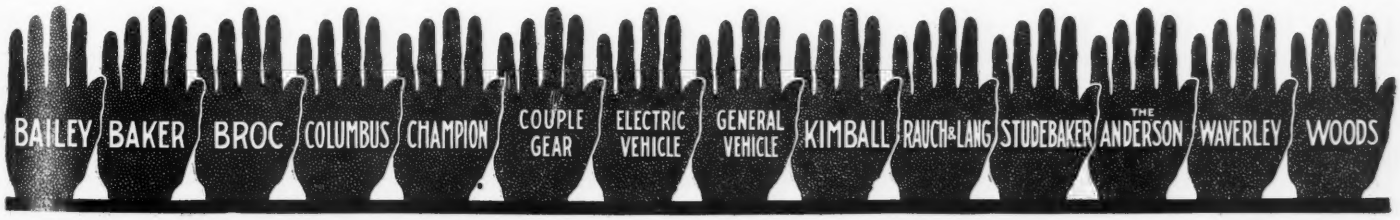

Over 90% of all Electric Vehicles manufactured use the "Exide" Battery.

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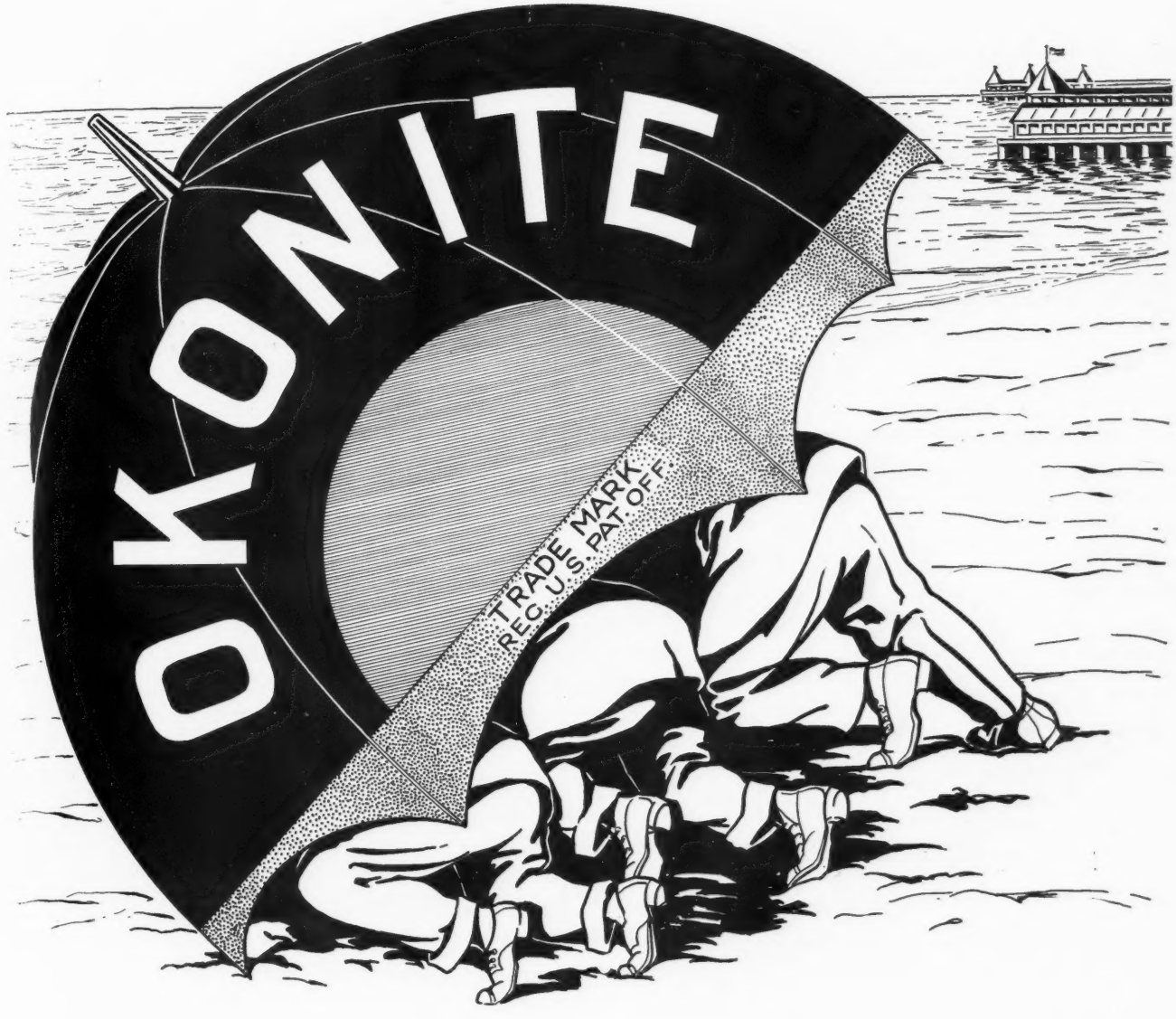

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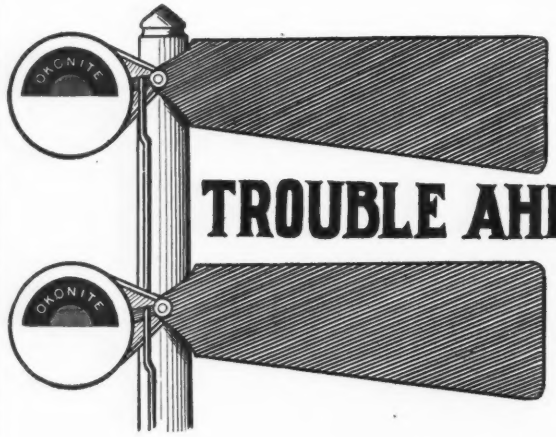

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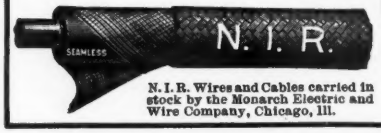
NATIONAL ELECTRIC CODE STANDARD



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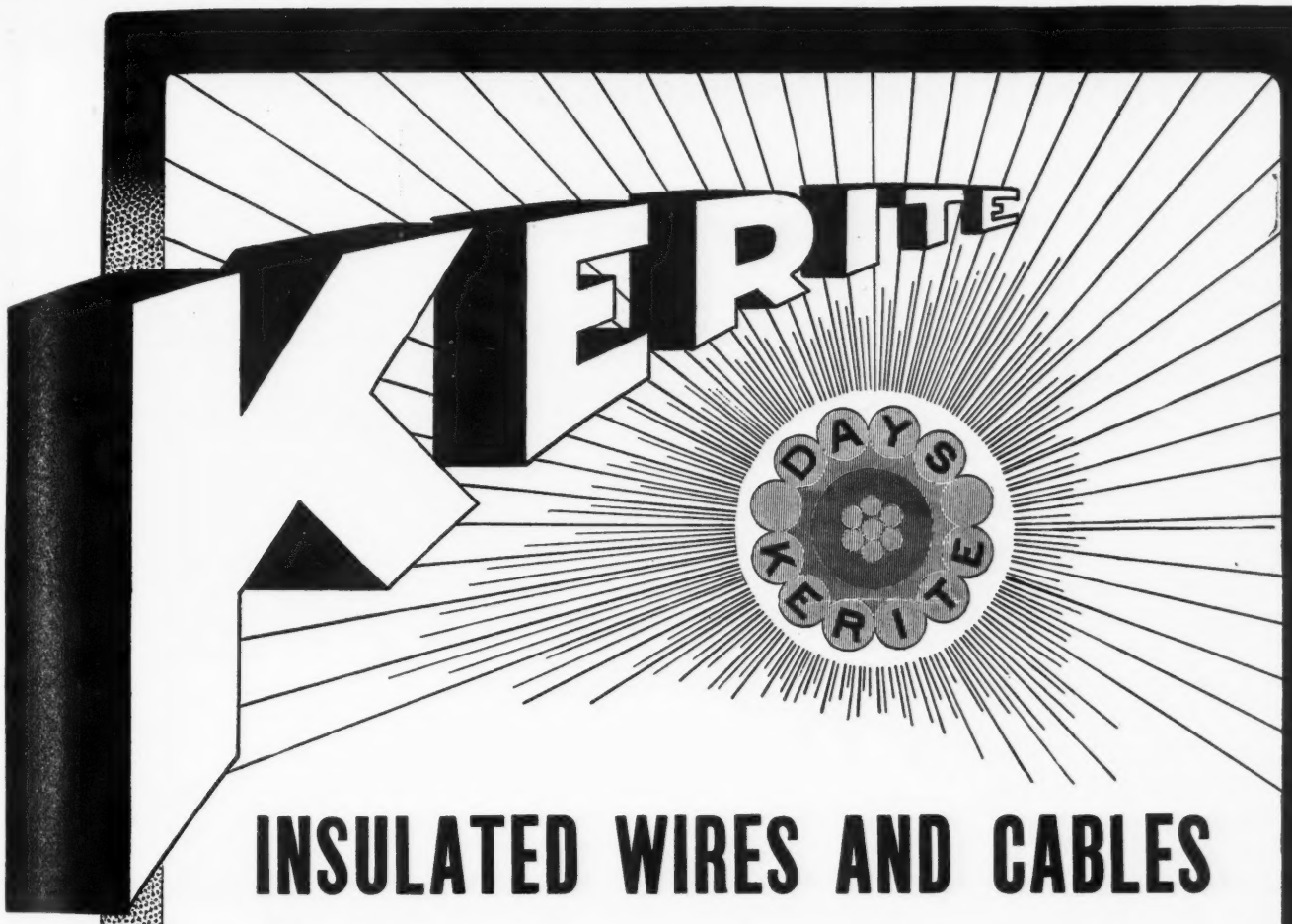

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KERITE has back of it an unequaled record of half a century of successful service under the most adverse conditions. It improves instead of deteriorating with age.

Efficiency and safety in electrical installations depend chiefly on insulation. For fifty years KERITE insulation has been the standard of excellence.

Results count. KERITE wires and cables installed half a century ago are in service today. The wonderful durability of KERITE insures the highest safety and economy.

Initial tests determine the properties of an insulation only at the time they are made. They do not determine how well it will do its work years afterward.

The indestructibility of KERITE and its power to resist deteriorating influences should be carefully considered in specifying an insulated wire or cable.

Experience of others should be useful to you. Insure your service by using KERITE.

KERITE INSULATED WIRE AND CABLE CO.

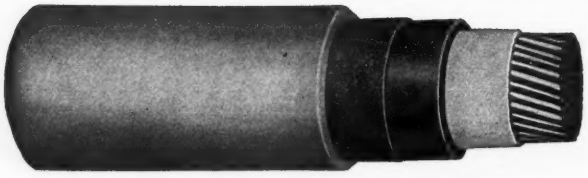
INCORPORATED BY W. R. BRIXEY

Hudson Terminal, - - 30 Church Street, New York.

Western Representative:

WATSON INSULATED WIRE CO.

Railway Exchange, Chicago, Ill.



Bishop Rubber-Insulated Wires and Cables

have been for a quarter of a century the standard of excellence. Experience counts. The final test for insulated wires and cables is TIME. **DURABLE EFFICIENCY** is one of the essential requirements exacted by discriminating purchasers. You cannot afford to pay for the experiments of the great number of new firms that are yearly entering the insulated wire industry. **"Bishop"** quality has been amply demonstrated through years of efficient service. The best insulated wires and cables produced today are **"Bishop."**
Let us send you samples. Estimates on request.

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420 East 25th St. NEW YORK

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For All Services

HABIRSHAW
RUBBER COVERED
WIRES
CABLES AND CORES.
(Trade Mark)

High and Low Pressure

Offices:
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OKONITE

OKONITE

Chicago

Tungstolite Fixture

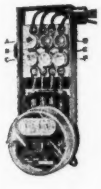
This fixture in conjunction with Tungsten lamps gives an effective weapon for fighting gas arc competition in stores, offices and shop lighting. For convenience in handling, each Tungstolite is packed in a separate box so that it can be reshipped without danger of breakage. The cost is low, efficiency high and shipments quick.

Fan Motors

Our new oscillating Fan Motor is the thing this season. It possesses the ability to move backward and forward through any desired angle and to revolve continuously in any direction. It is like our fan proposal, very unusual, practical and simple.

Before closing the year's business write us about these two features.

Fans are shipped from Chicago stock.



Meter Connection Block

Once upon a time a man said there was no moral protection against theft of current, and we differed with him on the ground that moral protection was effective only when it increased the chances of the thief being caught and thus lessened the liability of his taking the chance.

Another man locked his barn after the horse was stolen. We can lock your meters ***now*** and prevent theft of current.

The Pocket Size Tungsto-meter

The increasing use of Tungsten Incandescent Lamps has developed the demand for a device which will instantly and accurately indicate the watt consumption of carbon, tantalum and tungsten lamps.

The Tungstometer absolutely meets these requirements, and every live central station will purchase this device as soon as its real merit is appreciated. The Tungstometer "shows" the man from Missouri, the skeptic who believes that Incandescent light is too expensive, the doubting Thomases who still cling to gas.

Remote Control Switch

We have a treatise on remote control switching which should be in the hands of everybody interested in the application of remote control to power and lighting.

Complete diagrams are given showing the safest and most economical method of controlling lamps, motors, pumps, theater and church lights, etc.

Pittsburgh Transformers

Have you noticed how much other transformer manufacturers have been obliged to improve their product since we began to use Silico-Vanadium Steel? You will remember that when an ordinary 5 K. W. transformer had a core loss of 62 watts the Pittsburgh loss was 55 watts. Steady improvement brought our losses down to 44 watts and other manufacturers now claim 45 watts. We are still improving. Better secure our proposition.

Tungsten Lamps

Our Baby Tungsten Sign Lamps embody some interesting features. 5 watt as compared to carbon lamps of 19.2 watts. As sign service is usually flat rated, their intrinsic value is at once established.

Demands for Tungsten Lamps are increasing. To meet it we are carrying 25,000 in stock. If you want 25 watt, 40 watt, 100 watt or 250 watt lamps quick, we have them in Chicago stock.

Opalux Reflectors

Opalux is fast becoming the recognized leader in modern reflectors and shades. The inherent cleanliness combined with its high efficiency are potent factors in meeting the demand for more and better illumination. From an economic standpoint you cannot afford to ignore Opalux, as its use will insure less breakage of Tungsten lamp filaments. Many lamps are broken when removing the ordinary shade for washing. Opalux has a smooth, patented surface, and simply needs dusting.

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RED CORE (N. E. Code)

A Quality of Wire That Will Stand the Test, and Show Great Reserve Strength

NOTE: In the science of rubber manufacturing no company has made progress equal to The Diamond Rubber Co. No other manufacturer, for instance, is so successful in removing from the raw material the elements which aid or hasten deterioration.

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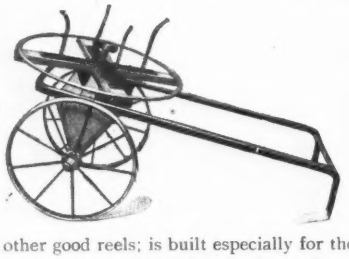
THE WASSON REEL



This reel and cart is made of steel and is strong and light and always ready for use; it has brake to keep wire from running away; can be anchored to the ground, and saves from one to two men's wages every week; will stand all kinds of hard usage and never needs shelter from the weather; does not cost more than other good reels; is built especially for the use of Electric Light Companies.

Price $12.00 net, 30 days, F. O. B. factory.

WASSON REEL CO. Clinton, Illinois

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REPAIR SHOPS

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High-Grade Machine Work of all kinds. Correspondence Solicited

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Electric Light Wire Telephone Wire

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We carry in Chicago stock a line of Standard Tapes and Webbings for the Electrical Trade including all styles and widths in general use for taping coils and other ordinary requirements. These are comprehensively described and priced in Belden Catalog No. 4, which will be sent free on request to those engaged in the Electrical business.

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RUBBER-COVERED
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The Best for Underground, Aerial, Submarine and Inside Use.

Telephone, Telegraph and Fire Alarm Cables

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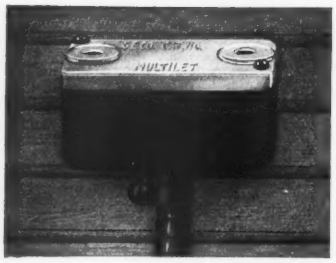
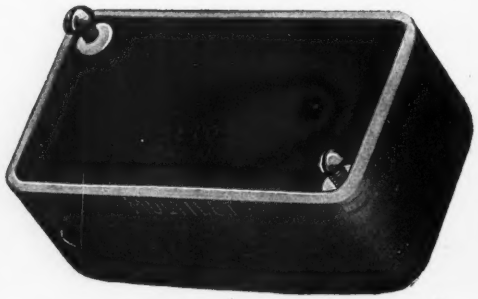
SPRAGUE MULTILETS

ONE BOX FOR MANY USES



2-Wire Porcelain Cover
No. 6302

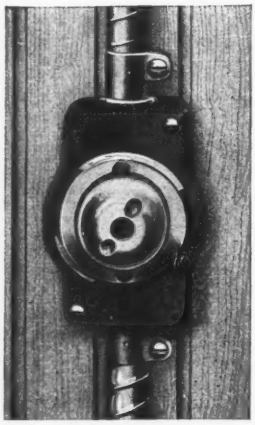


Multilet Nos. 6300 and 6400

ECONOMY CONVENIENCE SIMPLICITY

3-Wire Porcelain Cover
Nos. 6303 and 6403

SPRAGUE MULTILETS



Nos. 5506, 7 and 8 Hubbell Floor
Rec. Cover. Nos. 6311 and 6411.

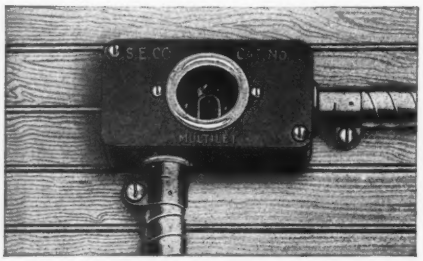
are certainly an excellent type of stamped steel knockout boxes and have many advantages over other makes. They simplify the stock problem, as the dealer or contractor does not have to carry an endless variety of types. No special fittings are required for special work and, hence, the wire man can complete his job without expensive delays.

Multilets are made in two sizes with a set of covers for each size. These provide for any combination for use with Rigid Conduit, Greenfield Flexible Steel Conduit or Flexible Steel Armored Conductors.

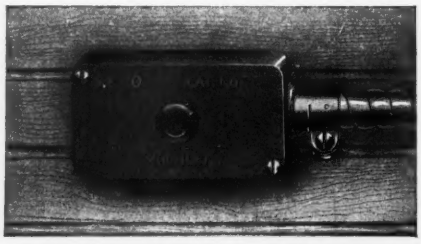
Multilets are small but have ample room inside for the wires. They accommodate standard fittings, such as receptacles, rosettes, snap switches, etc. Boxes and covers, with the exception of porcelain covers, are furnishcd in either galvanized or black enameled finish.

Try the Multilets and you will recognize their superiority. Write for a copy of our new Catalogue No. 424-6.

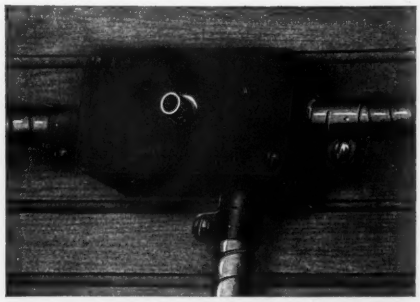
Cover for 5-Amp. Snap Switches
Nos. 6312 and 6412



No. 6, 6A and 6B Benjamin Rec. Cover
Nos. 6310 and 6410



Pendant Cover with ½-in. and ⅜-in. Insulating Bushings
Nos. 6314, 6414, 6315 and 6415



½-inch Male Nipple Cover
Nos. 6304 and 6404

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are perfectly adapted for Street Series Lighting in residential sections of a city or in parks, groves, etc., where trees and heavy foliage are found. The use of a large number of small units permits a more general distribution of the lamps, resulting in uniform illumination.

Sunbeam Tungsten Lamps

of different candlepower may be operated on the same circuit and thus the amount of illumination adjusted to the various localities.

Our Bulletin No. 5533 on Incandescent Lighting should prove of Interest to you.

—Send For It—

We are in a position to furnish promptly from stock 25-40-60-100 and 250-Watt Multiple Tungsten Lamps.

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EASTERN	CENTRAL	WESTERN	PACIFIC
New York	Chicago	Saint Louis	San Francisco
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Hawthorn Standard Ceiling Fan
with Chandelier Attachment

The Convention-

al way of keeping cool is by using

Hawthorn Fans

They will make your office and your customer's office a pleasant, livable place despite the heat of summer.

Hawthorn Fans are furnished in desk, combination desk and bracket, ceiling, oscillating, booth and exhaust types.

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Combination desk and bracket types	8", 12" and 16"
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Telephone Booth type - - - - -	8"
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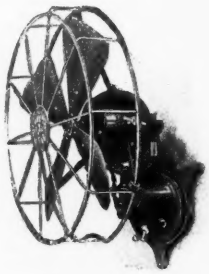

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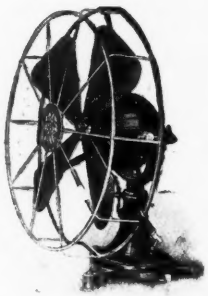
as a bracket fan

Made in both direct and alternating current types for use on all commercial circuits.



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Every Hawthorn Fan is Guaranteed

Send for our 1909 Fan Motor Catalogue No. 319

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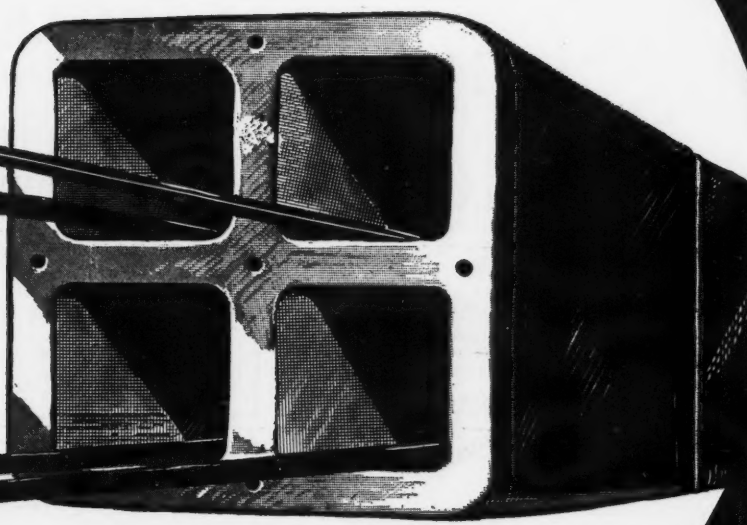
CAMP-DUCT



THE BEST UNDERGROUND CONDUIT

since the spirit of Economy first led men to take wires down from exposed poles to put them under the earth. "CAMP QUALITY"—Dependability, Durability, Economy.

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Manufacturers of **VITRIFIED CLAY CONDUITS**

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TRADE Wireduct MARK

THE BEST FLEXIBLE NON-METALLIC CONDUIT ON EARTH

WIREDUCT

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Manufacturers of "AMERICAN" CONDUIT

TRADE Wireduct MARK

The general manufacturing specifications of

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will undoubtedly be of interest to every engineer engaged in conduit construction.

It shall be thoroughly insulated.
It shall not be affected by heat up to 212° Fahr.
It shall not be affected by acids.
It shall be free from corrosive substances.
The bore shall be uniformly straight.
The inner surface free from dents or obstructions and from rough or fluky areas.

Briefly, these are the conditions that govern the inspection of Orangeburg Fibre Conduit and these same requirements insure a uniformity not usual in other types of conduit.

There are, of course, other requirements peculiar to the several types of Orangeburg Fibre Conduit rendering each suitable for installations of various sorts.

THE FIBRE CONDUIT CO. REG. U.S. ORANGEBURG PAT. OFF. ORANGEBURG, N.Y.

The Conduit Book explains such matters in detail and illustrates the progress of many installations.

A copy of this book will be sent free on request.

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Chicago Office: 1741 Monadnock Building.
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Resistance Wire. Wire and Sheet for All Purposes.

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to commence laying your wires underground

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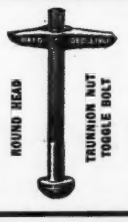

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With Double-Flanged Sides and Rigid-Backs

For securing Brackets and Fixtures to Hollow Tiling, Marble Slabs, Steel Ceilings or Plastered Walls, where Screws or Nails fail to hold.

Write for discounts

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You may think your wires are sufficiently protected —

You may guess that they are all right —

But — Do you know?

The use of GENUINE "CIRCULAR LOOM" —the Ideal Flexible Conduit — makes you absolutely certain that you have the Very Best Mechanical Protection against injury to your wires.

GENUINE "CIRCULAR LOOM"

is a product of Quality — first — last — all the time. It is Weatherproof — Waterproof — Fireproof — Resists Abrasion — Will Not Collapse. Nothing less than these Qualities would be satisfactory to us — they should be acceptable to you.

GENUINE "CIRCULAR LOOM" is Thoroughly Flexible at all Seasons — and Fishes easily.

All these Qualities make GENUINE "CIRCULAR LOOM" the Very Best Mechanical Protection for your wires.

That's all it is. And — It is all of That.

Specify GENUINE "CIRCULAR LOOM"

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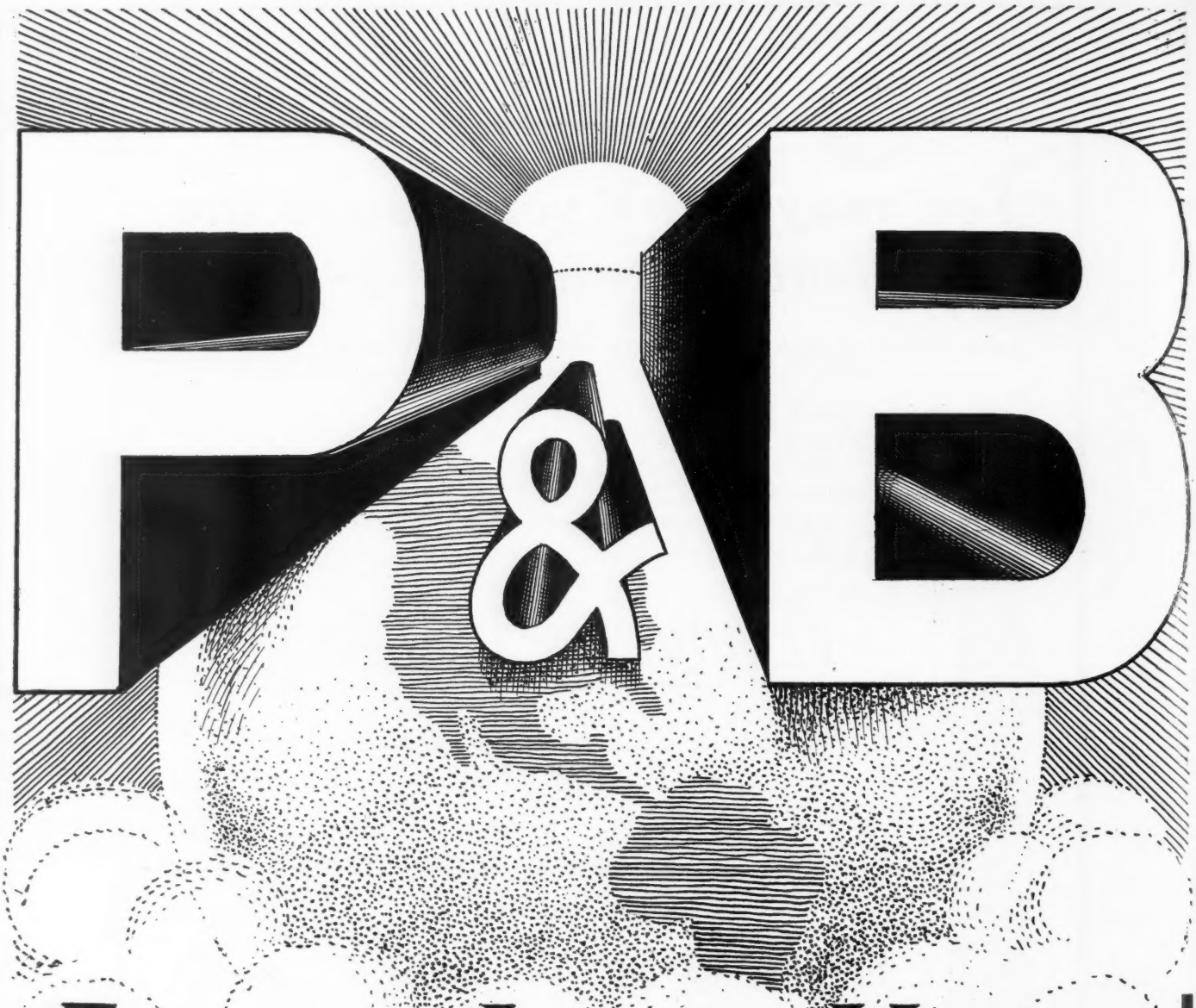

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Manufactured
With best imported soft mica free from iron
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With machines and instruments of precision to assure accuracy
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Constitute a material of world wide reputation for quality

THAT IS MICANITE

Manufactured solely by
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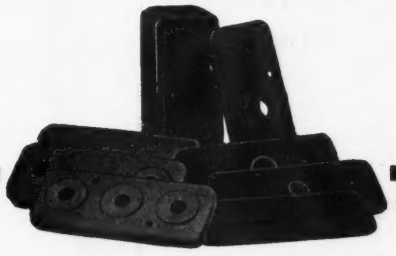

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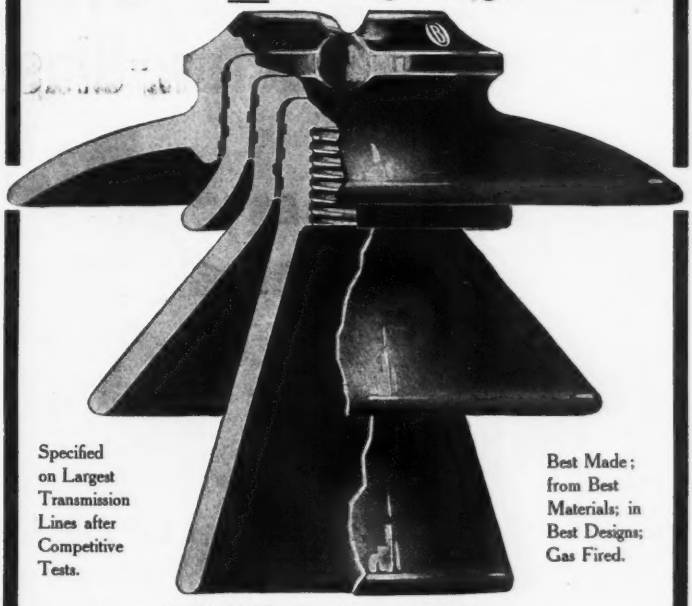
O-B Hi-Tension Insulators

For All Working Voltages



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Best Made; from Best Materials; in Best Designs; Gas Fired.

No. 9418 Four-Piece, Cemented, 60,000 Volts

New 104-page Catalogue shows full line of Insulators and Pins, Cross-Arms, Braces, etc. Write for copy. Mention adv.

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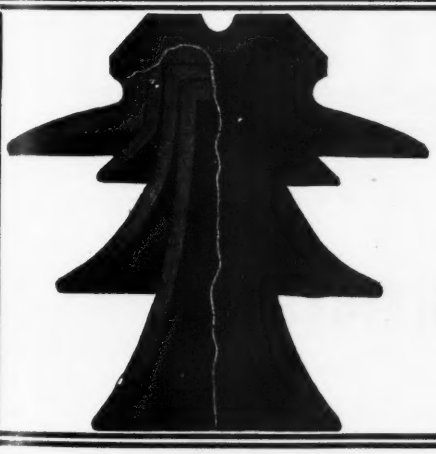
NEW YORK PITTSBURG CHICAGO



INSULATORS BURNED IN A GAS FIRE

are thoroughly vitrified, have a uniform color, contain none of the impurities found in coal-fired insulators and particularly **NO SULPHUR.** Increased efficiency assured.

Insulators of All Types and of All Voltages

Let us advise you. Send us details of your requirements, stating line voltage. Let us send you samples of the type of insulator in our judgment best qualified to serve your requirement. We think we can offer you very attractive estimates.

The New Lexington High Voltage Porcelain Co.
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Screw-Glass Insulators

BEST FOR ALL PURPOSES

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SEE THE TEATS ON THE PETTICOAT

THEY PREVENT CREEPING OF MOISTURE
AND KEEP THE PIN DRY

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The one distinguishing feature of

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STANDARD SCREW-GLASS INSULATORS

is that they never vary in quality, it is always of the very highest.

They furnish efficient and satisfactory service at all times, cost little, last long and are the most economical to use. They are the most successful high-efficiency Insulators yet devised.

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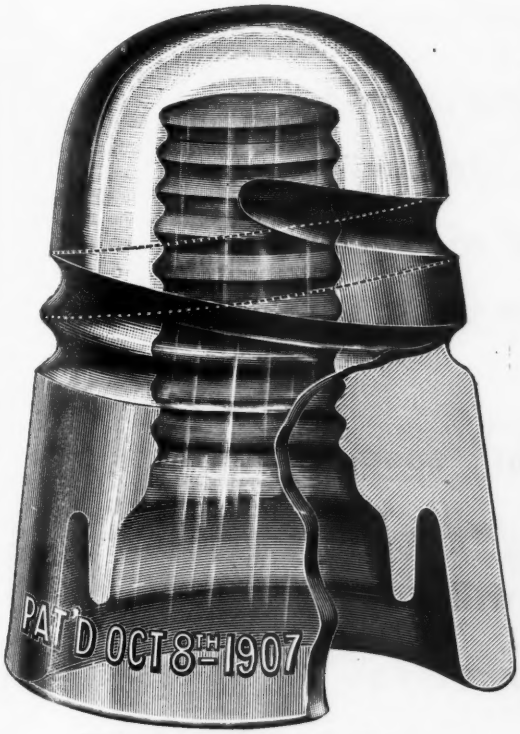
Glass Insulators

With or Without Drip Points

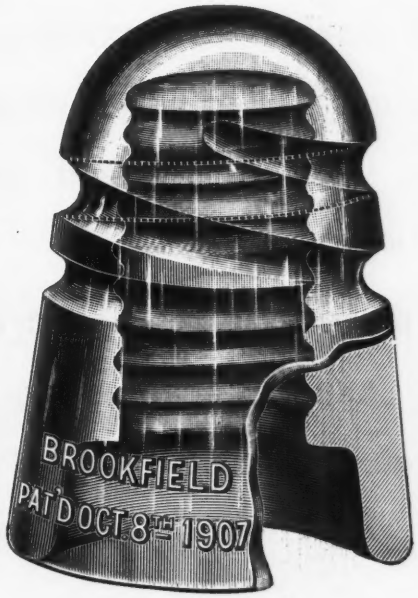
The Standard for 40 Years

COMBINATION SAFETY

Designed to prevent dropping of line wire to cross-arm if tie wire breaks, and to eliminate the necessity of tying to every insulator.



Western Union Double Petticoat Pattern



Pony Pattern

Deep Groove Double Petticoat Pattern

THE BARCLAY IMPROVED INSULATOR

The spiral groove on its outer surface is so threaded that when unscrewed from its pin, the tie holding the wire is also unscrewed or removed from the insulator. The reverse operation screws the insulator on the pin and at the same time puts the tie wire back in its original position on the insulator. The object of this insulator is to save labor and expense in renewing glasses when broken or otherwise defective, and in the transfer of wires from one position on a pole to another, all of which is accomplished without untying and re-tying the wire.

MANUFACTURED BY

THE BROOKFIELD GLASS COMPANY, 2 Rector Street, New York

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, 507 Marquette Bldg., Chicago
NEW YORK, 13 Park Row LONDON, E. C., 42 Old Broad St.

You are going to the National Electric Light Convention.

Or, if you are not going, you will want to read all about it.

Therefore you will read the Report Numbers of the

Electrical Review and Western Electrician

These will be dated June 5 and June 12.

The first day's proceedings, description of exhibits and a bird's-eye view of convention matters in general will be published June 5.

The complete report, prepared specially by our own expert staff, who will be in attendance at Atlantic City, will appear June 12.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, 507 Marquette Bldg., Chicago
NEW YORK, 13 Park Row LONDON, E. C., 42 Old Broad St.

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These Report Numbers are always sought for.

They are widely read and carefully preserved.

They will epitomize the state of the art in respect to electric lighting and central-station operation as it is today.

Every advertiser who does business in this great branch of the electrical industry will have a special advantage in appearing in these numbers.

The eyes of the entire industry will be focused on the columns—both reading and advertising—of the

Electrical Review and Western Electrician

Take advantage of it.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, 507 Marquette Bldg., Chicago
NEW YORK, 13 Park Row LONDON, E. C., 42 Old Broad St.

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INCANDESCENT LAMPS

Of every type. For every service. If it's an Incandescent Lamp we have it—we make it, with big improvements in every detail.

Bryan-Marsh Tantalum, Bryan-Marsh Double Filament Carbon, Bryan-Marsh Gem, Miniature (both Carbon and Tungsten), Bryan-Marsh Street Series Tungsten.

Here is a line you can't beat. Enhanced efficiency places these lamps in a class apart—they fulfill all the positive requirements of their type and do a little more. Improvements have been effected in every important detail, augmenting the efficiency and durability of the lamp without increasing the current consumption or adding to the cost. We are in a position to guarantee exceptionally prompt deliveries. Orders may be filled from any one of our branches or from live dealers everywhere. Let us quote you on your requirements.

Branches:

Bryan-Marsh Co., New York. Bryan-Marsh Co., Minneapolis, Minn.
Bryan-Marsh Co., Oakland, Cal.
Bryan-Marsh Co., Cincinnati, Ohio. Bryan-Marsh Co., Denver, Colo.
Bryan-Marsh Co., New Orleans.

BRYAN-MARSH CO.

Chicago, Ill.

LOOK FOR THE LICENSE LABEL

MARSH
TUNGSTEN LAMPS

The most efficient of all incandescent lamps

BRYAN-MARSH TUNGSTEN LAMPS

represent the highest achievement of modern lamp makers. They are the most powerful and durable illuminants known to science. Give more light, and better, steadier, and purer light than any other type, approaching daylight in brilliancy and clarity of illumination.

Economy

The Bryan-Marsh Tungsten consumes less current than the ordinary carbon filament lamp. For any given current consumption it will give over 50 per cent more light, and more reliable service in every detail. Install Bryan-Marsh Tungstens and you will find a saving of 65 per cent when your lighting bill comes in. We have published definite figures of unimpeachable trustworthiness showing the positive saving in cost of these Tungstens over every other type of incandescent lamp. They reduce maintenance cost to a minimum, last long, and give satisfaction at all points.

Study these figures

The reductions in renewal outlay actually halve the cost—they **last.**

Bryan-Marsh Tungsten Lamps

Wattage		Standard Pkg. Quantity	Clear	Bowl Frosted
5	Sign Type	100	$0.50	$0.55
25		100	0.85	0.90
40	Small Bulb	100	1.00	1.05
40		50	1.10	1.15
60		50	1.40	1.47
100		24	1.75	1.85
40	No. 1 Meridian	24	1.50	1.50
60	No. 2 Meridian	24	1.75	1.75

Bryan-Marsh Tungsten Lamps

BRYAN-MARSH CO.

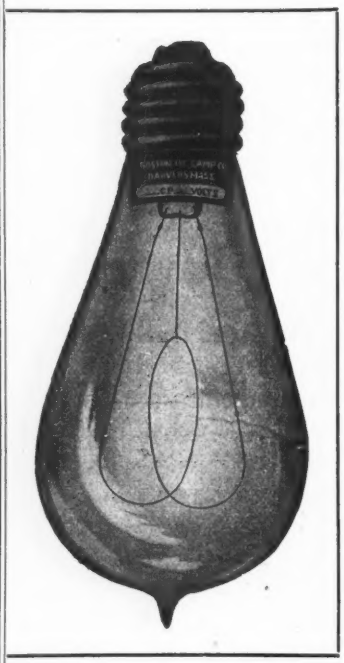
Central Falls, R. I.

"JUST AS GOOD AS

'Boston' Lamps"

MAY BE USED AS AN ARGUMENT
BY OTHER RENEWERS—BUT
REMEMBER

BOSTON RENEWED LAMPS



ARE ALL GUARANTEED AND

ARE QUALITY LAMPS!

THEY ARE

WINNERS

IN THE REALM OF RENEWED
LAMPS, BECAUSE

Price and Quality are Right!

ANY VOLTAGE 100 to 130. ANY CANDLEPOWER 4 to 16

9c F. O. B. DANVERS

DISCOUNTS TO DEALERS. PROMPT SHIPMENTS.
SEND ALL RENEWED LAMP ORDERS TO

BOSTON INCANDESCENT LAMP CO.

DANVERS, MASS.

ALL TYPES

IMMEDIATE DELIVERIES

ALL SIZES

TUNGSTEN-CARBON

THE Fostoria LAMP

TANTALUM-GEM

BRANCHES:

Atlanta, Ga.
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Norfolk, Va.
78 Commerce St.

St. Louis, Mo.
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THE FOSTORIA INCANDESCENT LAMP CO.
FOSTORIA, OHIO

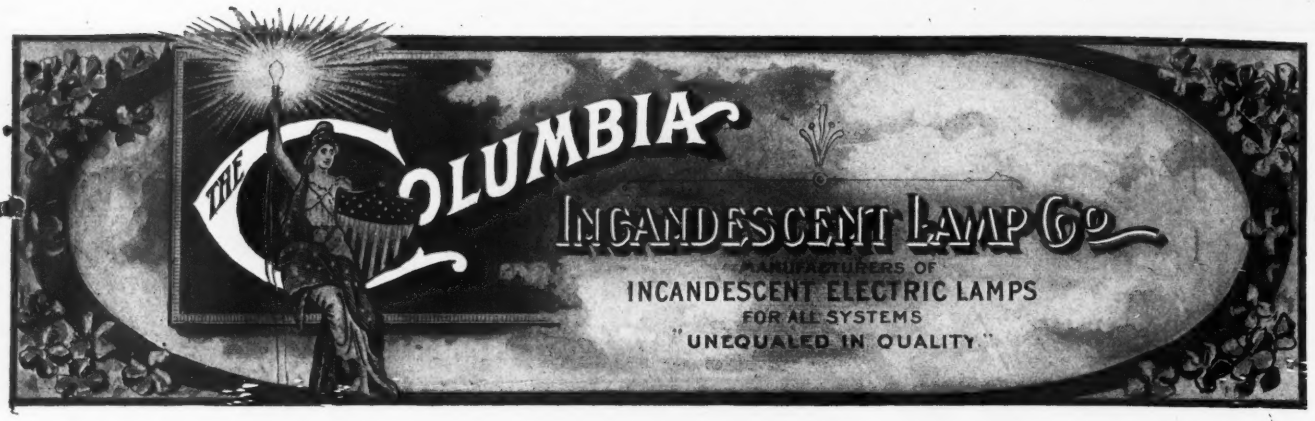
BRANCHES:

St. Paul, Minn.
185 E. 4th St.

Oakland, Cal.
12th and Clay Sts.

Chicago, Ill.
211 Lake St.

Agencies and Stocks Everywhere



Columbia Carbon Filament Lamps

Of all types and styles

Columbia Tungsten Lamps

25 to 250 watts, including regular multiple, meridian, miniature and street series.

Columbia Tantalum Lamps

Both regular and meridian type.

Columbia GEM Metallized Filament

In 40, 50 and 80 watt sizes.

We solicit correspondence and an opportunity of submitting prices and all other information.
Prompt shipments and courteous treatment assured.

THE COLUMBIA INCANDESCENT LAMP CO.

Established in 1889

MAIN OFFICE AND WORKS:

2115-17-19 Locust Street, ST. LOUIS, MO.

BRANCH OFFICES:

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Boston, 170 Purchase St.
Philadelphia, 1221 Real Estate Trust Bldg.
Chicago, 264-270 Fifth Ave.
Minneapolis, 1044 Security Bank Bldg.
Memphis, Randolph Bldg.
Dallas, 427 Wilson Building
San Francisco, 155 New Montgomery St.

Packard

25, 40 (both small and skirt Edison base), 60, 100 and 250 watt Tungsten Lamps

Street Series, Miniature, Sign and Low Voltage Tungsten Lamps

1¼ Watts per Candle, 100 to 125 Volts
STANDARD EDISON BASE

Orders accepted for prompt shipment. Service up-to-date and efficient. Write for quantity prices and name of nearest agent; also copy of our very latest price list. All standard commercial lamps manufactured and sold by

NEW YORK & OHIO COMPANY

WARREN, OHIO

COLONIAL LAMPS

COLONIAL High Quality LAMPS

TUNGSTEN
TANTALUM
GEM
CARBON FILAMENT

Represent the Highest Excellence Attained in Lamp Construction

Specify "COLONIAL"

This is the time of the year when the heavy lighting load comes on. No doubt you have had your own troubles with flickering, uncertain light, enormous current expenses, unexpected burn-outs and all the other defects of the ordinary sort of lighting service. You can eliminate trouble of this sort by raising your lamp standard—specify the best. You will find out for yourself, after a short trial, why progressive Central Station men all over the country specify **"Colonial."** They know that they please the customer—that complaints cease when "Colonial" Lamps are installed. They know that a "Colonial" Lamp of whatever type it may be—from Tungsten to Carbon Filament—is always a little bit better than the next. Colonial Lamps give satisfaction every minute they burn.

Colonial business methods are of the sort that make friends of every dealer who handles Colonial Lamps. Let us have your order now—let us demonstrate to you our ability to suit your lamp needs and come up to your ideas of fair dealing. We have **new prices,** full stocks, and are ready now to fill orders of any size on shortest notice. Write.

THE COLONIAL ELECTRIC CO.

WARREN, OHIO

New York Office:
136 LIBERTY STREET

What Do You Think of This? A Tungsten Turn-Down Lamp

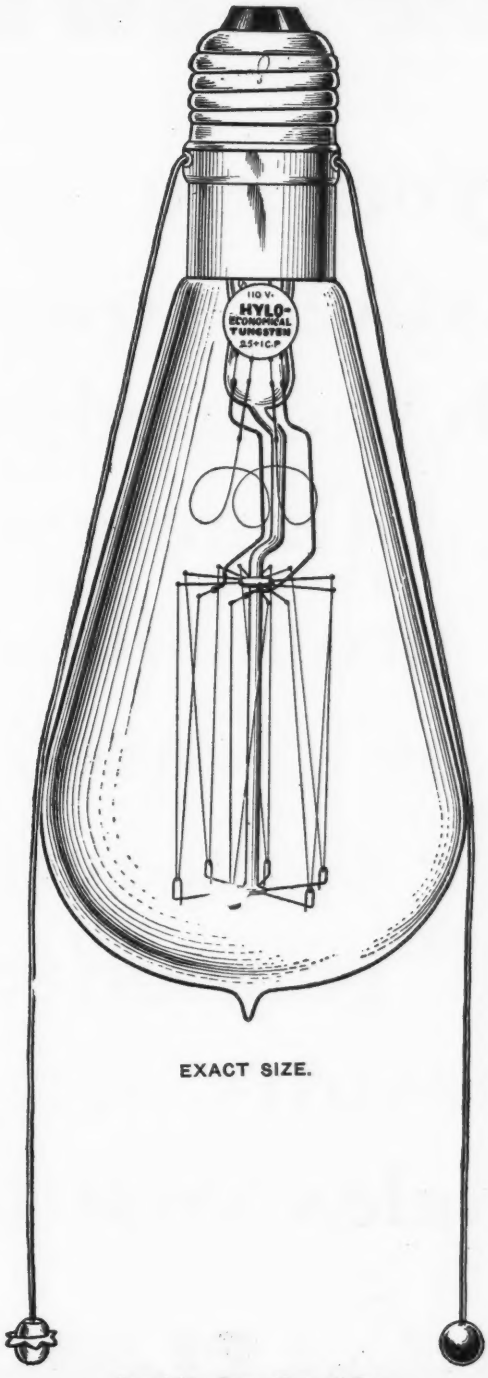
THE HYLO-ECONOMICAL

Tungsten Filament
35 W., 27 CP.

Small Filament (Carbon)
8 W., 1 CP.

Made in Voltages
100 to 125

Standard Package Contains
100 Lamps



EXACT SIZE.

No. 1

Economical Pull-String

No. 2

Economical Turn-Bulb

No. 7

Hylo Pull-String

No. 6

Economical Long-Distance

See It in Operation at the
N. E. L. A. Convention—Booth L.

Write for Prices and Descriptive Matter.

Economical Electric Lamp Company
25 West Broadway, NEW YORK

MR. CENTRAL

If you are interested in increasing your business through the medium of Tungsten and Tantalum Lamps, we have a proposition which we would be pleased to submit for your consideration which we will guarantee will produce results without additional sales cost to you.

The Banner Electric Company

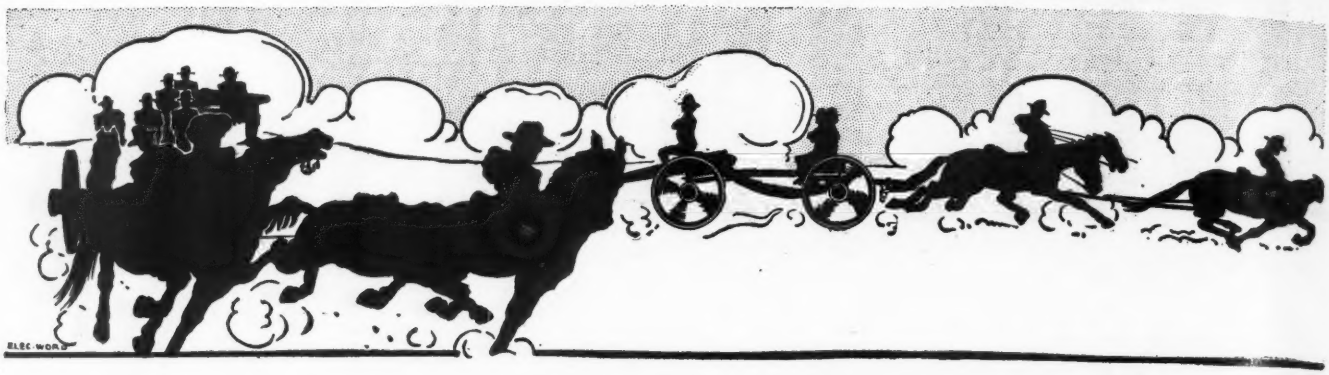
YOUNGSTOWN, OHIO

STATION MAN

If you have new installations which require the services of illuminating engineers, we have experts whose services are at your disposal. We propose to increase our business by increasing yours. This is a business proposition for more business. Ask us.

The Banner Electric Company

YOUNGSTOWN, OHIO



Winning Tactics in the

The Heavy Artillery

in the fight against competition in the lighting field is surely the tungsten lamp, and of these

Buckeye Tungstens

are the most powerful opposition suppressors. Use Buckeye Tungstens to give your customers double illumination without increased cost and competition will not mean more to you than does a street row to an army brigade.

LOOK FOR THE LICENSE LABEL

BUCKEYE ELECTRIC CO.

BUCKEYE AGENTS.
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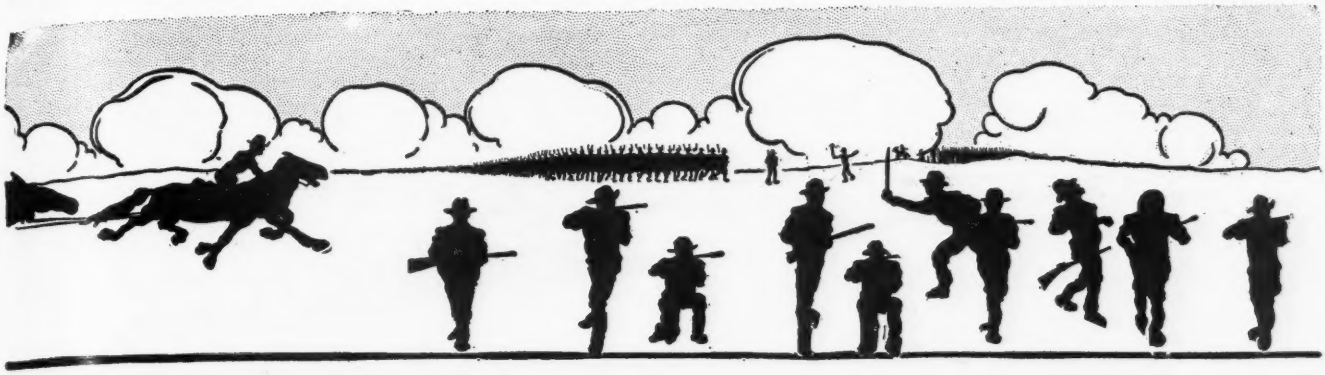
Post-Glover Elec. Co., Cincinnati, Ohio.
Wheeler-Green El. Co., Rochester, N. Y.
Dunham, Carrigan & Hayden Co., San Francisco, Cal.
Nebraska Elec. Co., Omaha, Nebr.
Erner & Hopkins Co., Columbus, Ohio.
Hide, Leather & Belting Co., Indianapolis, Ind.
W. C. Teas, Chattanooga, Tenn.
Butterworth & Reiter, Dayton, Ohio.
O. J. Goettmann, Pittsburg, N. S., Pa.
Chicago, 23 E. Lake St.
Pittsburg, 714 Ferguson Bldg.
Dallas, Linz Bldg.
Atlanta, 302 Candler Bldg.
Machine Elec. Sup. Co., Muncie, Ind.
Springer & Patterson, Pittsburg, Pa.
Carter Electric Co., Pittsburg, Pa.

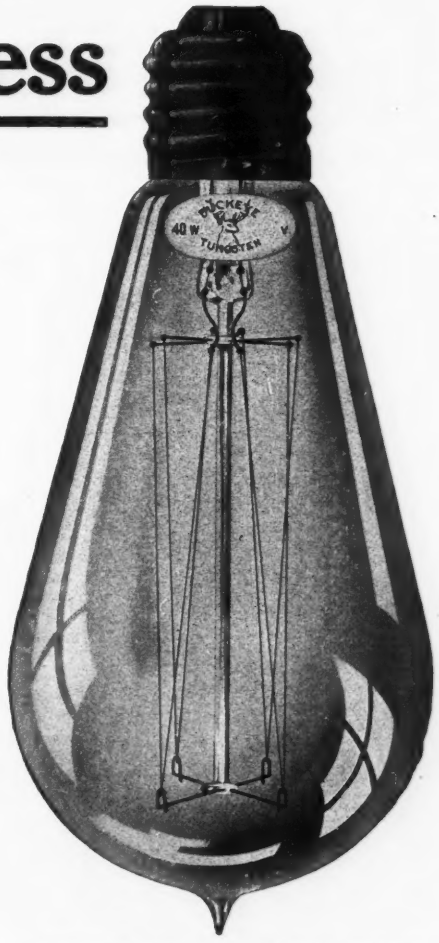


Battle for Business

Reserves

Our newest type of small bulb, regular EDISON base (not skirted)

40-Watt Buckeye Tungsten



Our New Small Bulb 40-Watt Buckeye Tungsten. For Use in Any Position and Will Fit Into Any Regular Shade or Fixture.

LOOK FOR THE LICENSE LABEL

CLEVELAND, OHIO

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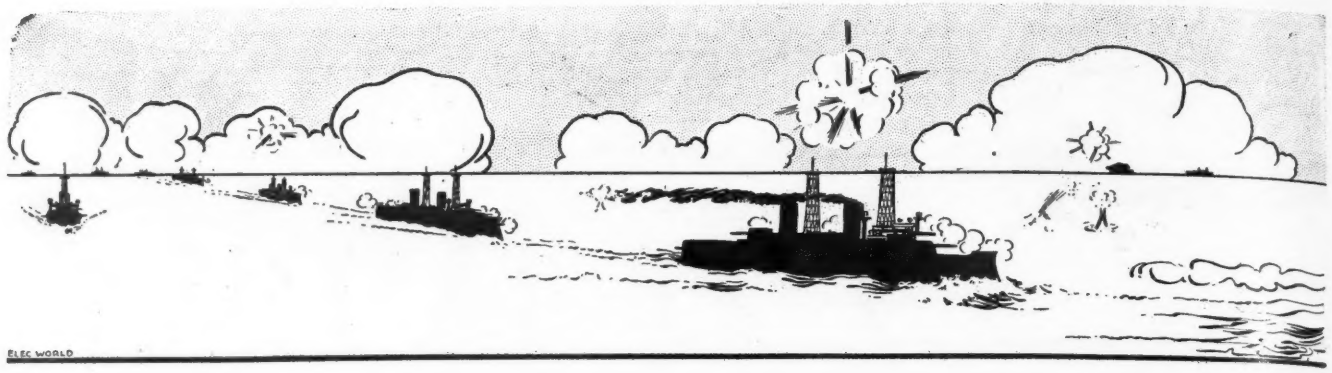
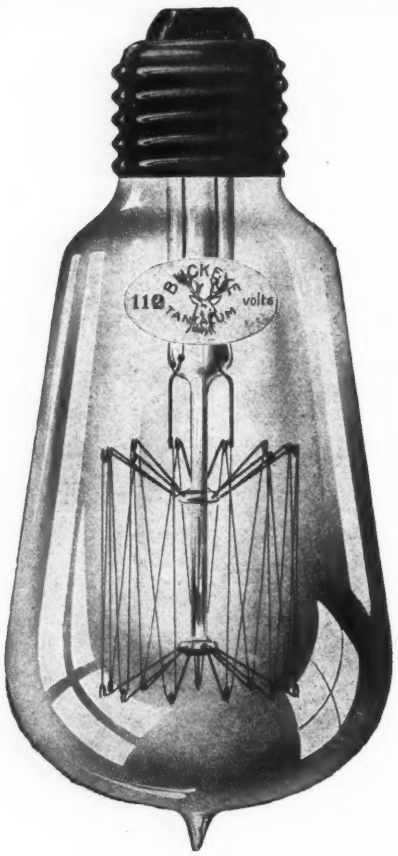
Chas E. Sharp, Security Bldg., St. Louis, Mo., Agt. Republic of Mexico.
E. S. Sprague, Marietta, Ohio.
American Machine & Mfg. Co., Charlotte, N. C.
Brown-Woods El. Co., Houston, Texas.
Thomas Engineering Co., Allentown, Pa.
W. L. Cummiskey Co., Syndicate Trust Bldg., St. Louis, Mo.
Marrs-Tanner El. Co., Danville, Ill.
Consolidated Engineering Co., Denver, Colo.
Kline Electric Co., South Bend, Ind.
Mohawk El. Sup. Co., Syracuse, N. Y.
A. Organ, 114 Liberty St., New York City.
Roekel Plbg. & El. Co., Zanesville, Ohio.
A. L. Swanson, Evansville, Ind.
Percival & Jones, St. Louis, Mo.
Trotter & Walker El. Co., Decatur, Ill.



In the Battle for Business



A New Recruit

Add to your force the newest and best of its kind—

Buckeye Tantalum

An entire new bulb with small Edison base (not skirted). An improved type of Tantalum Lamp for A. C. or D. C. Circuits.

LOOK FOR THE LICENSE LABEL

BUCKEYE ELECTRIC CO.

BUCKEYE AGENTS.
Frank H. Stewart El. Co., Philadelphia, Pa.
Post-Glover Elec. Co., Cincinnati, Ohio.
Wheeler-Green El. Co., Rochester, N. Y.
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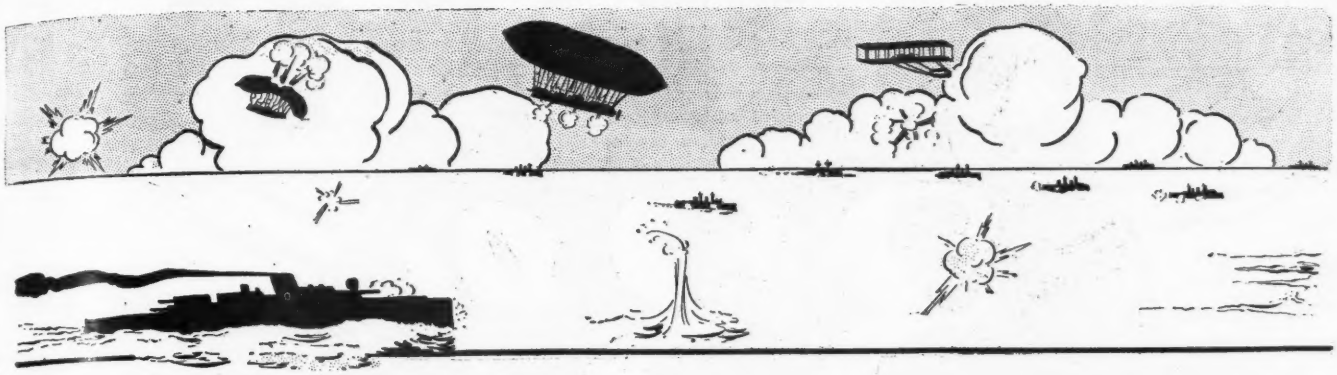
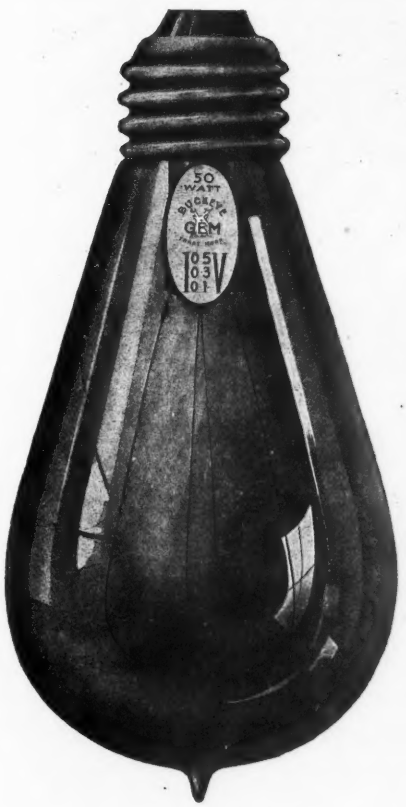
Nebraska Elec. Co., Omaha, Nebr.

Erner & Hopkins Co., Columbus, Ohio.
Hide, Leather & Belting Co., Indianapolis, Ind.
W. C. Teas, Chattanooga, Tenn.
Butterworth & Reiter, Dayton, Ohio.
O. J. Goettmann, Pittsburg, N. S., Pa.
Chicago, 23 E. Lake St.

Pittsburg, 714 Ferguson Bldg.
Dallas, Linz Bldg.
Atlanta, 302 Candler Bldg.
Machine Elec. Sup. Co., Muncie, Ind.
Springer & Patterson, Pittsburg, Pa.
Carter Electric Co., Pittsburg, Pa.



it's Science that Wins



The Heroes

of many a hard-fought skirmish and still a strong line of defense, safe to fall back upon any time,

Buckeye Standard

GEM and CARBON

There never was a better line of lamps than the Buckeye line. In massing your forces don't overlook the Buckeye miniatures. Want details of all of this? Just drop us a line.

LOOK FOR THE LICENSE LABEL

CLEVELAND, OHIO

Dauphin Electrical Sup. Co., Harrisburg, Pa.
Chas. E. Sharp, Security Bldg., St. Louis, Mo.
Agt. Republic of Mexico.
B. S. Sprague, Marietta, Ohio.
American Machine & Mfg. Co., Charlotte, N. C.
Brown-Woods El. Co., Houston, Texas.
Thomas Engineering Co., Allentown, Pa.
W. L. Cummiskey Co., Syndicate Trust Bldg., St. Louis, Mo.
Marrs-Tanner El. Co., Danville, Ill.
Consolidated Engineering Co., Denver, Colo.
Kline Electric Co., South Bend, Ind.
Mohawk El. Sup. Co., Syracuse, N. Y.
A. Organ, 114 Liberty St., New York City
Roekel Plbg. & El. Co., Zanesville, Ohio.
A. L. Swanson, Evansville, Ind.
Percival & Jones, St. Louis, Mo.
Trotter & Walker El. Co., Decatur, Ill.

ECONOMY

33%

OFF YOUR LAMP BILLS

Strictly a Business Proposition

We can fill your requirements at a cost of at least one-third less than you have been paying. We can do this without lowering the quality of your lighting service.

BRIGHT Renewed LAMPS

are as satisfactory in practical service as any lamps made and cheaper in price than any other make of the same grade.
A trial will convince you.

Let us demonstrate to you our ability to fulfill all the claims [we [make] for Bright renewed lamps. Send us a trial order. We will positively guarantee Bright lamps in all essential points.

WRITE AT ONCE FOR OUR PROPOSITION

LICENSE LABEL

The Economy Electric Company

WARREN, OHIO

Westinghouse

Tungsten Lamps

For Alternating or Direct Current Circuits
1¼-W. P. C.

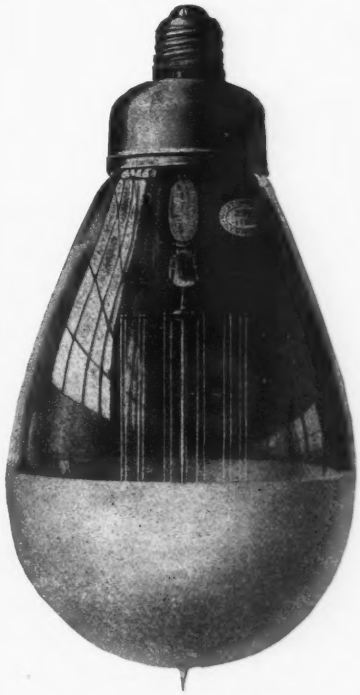
Westinghouse 60-Watt Tungsten
Frosted Bowl

Westinghouse 40-Watt Tungsten
Small Bulb

A new factory
new apparatus
and
new processes

have resulted in the development of the Westinghouse Perfected Tungsten Lamp in a variety of sizes and styles, as can be seen by the examples here illustrated. They are similar in general appearance to our well-known carbon lamps. These lamps give an extremely white light and are the nearest approach to daylight of any illuminant.

Westinghouse Street-Series Tungsten
No Fusing



Westinghouse 250-Watt Tungsten

Westinghouse Electric & Manufacturing Co.

Atlanta Boston Chicago Cleveland Denver Kansas City Minneapolis New York Pittsburg Salt Lake City Seattle
Baltimore Buffalo Cincinnati Dallas Detroit Los Angeles New Orleans Philadelphia St. Louis San Francisco Syracuse
Canada: Canadian Westinghouse Co., Ltd., Hamilton, Ont. Mexico: G. & O. Braniff & Co., City of Mexico

THE "JUST" TUNGSTEN (Wolfram) LAMP

(Made in Germany)

What Everybody Has Been Waiting For!

Ready for Delivery:

16 C. P. 18 WATTS

100 to 120 volts, list price, **85c**

The same in 2¾-inch Round Bulb, list price, **$1.10**

These Lamps contain our latest improvements. All other c. p. and voltages from stock or for direct importation. For further discount and exclusive agencies, write to the

Sole Representatives for the United States,

The Electrical Accessaries Company

1135 Broadway, New York City

S. E. A. BATTERY

Photograph of 55 cells, 200 ampere-hours, weight complete 3,630 pounds. Space occupied by rack 17 inches wide, 11 feet long by 7 feet high. In daily use at our factory for three years.

THE S. E. A. BATTERY gives more capacity for lighter weight and occupies less space than any other battery on the market.

The simplicity of construction enables us to sell batteries at extremely low prices.

The Standard Electric Accumulator Company

91-93 Mercer Street, NEW YORK CITY

F. B. BADT & CO.,
1505 Monadnock Block, Chicago, Ill.
Western Selling Agents

GEORGE F. TALCOTT
53 State Street, Boston, Mass.
Agent for New England

The Universal Westinghouse Nernst Cluster

Lowest First Cost

Lowest Cost of Maintenance

This cluster when equipped with Westinghouse Nernst Burners represents the strongest weapon available to Lighting Companies for fighting gas and gasoline competition.

It possesses the additional advantage of being the only cluster on the market interchangeable for Westinghouse Nernst Burners and other incandescent renewals.

This means that Central Stations are placed in a position to meet the demands of their customers by carrying only one type of cluster.

Send for Circular

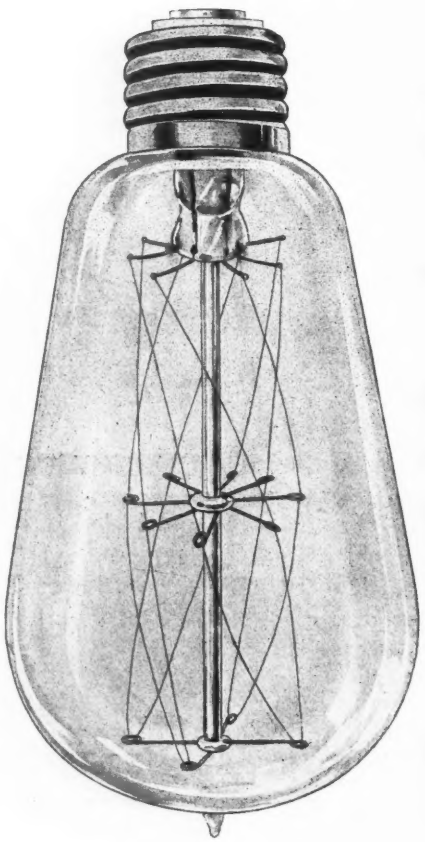
NERNST LAMP COMPANY

PITTSBURG, PA.

OFFICES IN ALL LARGE CITIES

NOTICE

To Incandescent Lamp Users



We still continue to manufacture carbon filament incandescent lamps—GOOD ONES, TOO!

We are prepared to take care of any order, large or small.

The fact that our factories have been working overtime is proof that we have as good a lamp as there is made.

Tungsten Lamps

See our display at the National Electric Light Convention at Atlantic City.

Regular Tungstens of original construction and the new

Any Angle lamps

These will burn at any angle—and we can prove it.

NOVELTY INCANDESCENT LAMP COMPANY

General Offices: Emporium, Pa.

ATLANTIC CITY, BOOTH "E"

General Western Selling Agents, FAIRBANKS, MORSE & COMPANY
Manufacturers of D. C. and A. C. Apparatus - Chicago, Illinois

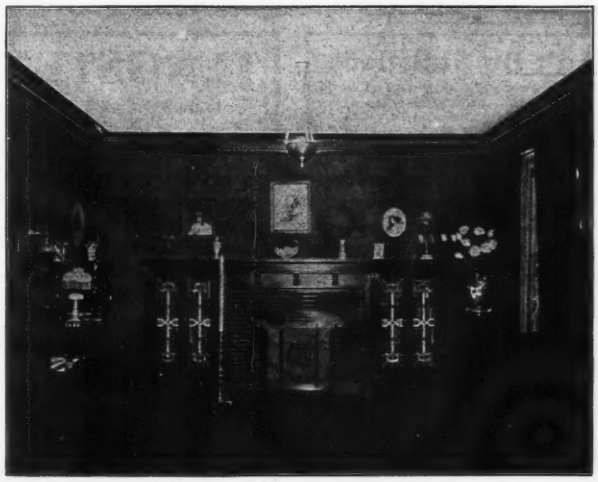
I-COMFORT System

A Practical, Efficient Method of INDIRECT ILLUMINATION

The best adapted for lighting

Residences, Offices, Halls Assembly Rooms Etc.

The Perfect Lighting System
The lamps are entirely concealed by inverted ~ reflectors, unique in design, set in neat brush brass receptacles.
The reflector surface is the most efficient known to Science.
This system affords a nearer approach to daylight than any other method of artificial lighting.



Room illuminated with one ~~ fixture containing 100watt Tungsten

This system secures splendid results without any increase of ~ current consumption. The cost is low enough to place it well within the reach of persons of moderate means. Prices on request.
~Write for full details. Catalog

Successful in Practical Service
This system is now long out of the experimental stage and has been widely adopted by the most critical of lamp users as the best method of interior illumination available.
Approved by Central Stations and endorsed by eye-specialists for the softness and purity of the light produced.

National X-Ray Reflector Co.
247 E. Jackson B'lv'd.
CHICAGO, ILL.

ELEC. REVIEW

LIGHTING FIXTURES

NEW DESIGNS BEARDSLEE QUALITY

No. 2453

"TUNGSTENS," Catalogue No. 18
ELECTRIC Only, Catalogue No. 15
GAS AND COMBINATION, Catalogue No. 14
Stock for Immediate Shipment, Catalogue "S"

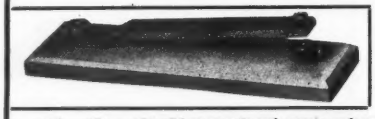
Every contractor, dealer or central station should have all of these catalogues. Check over the list and tell us which is missing. We will supply it free prepaid to dealers. All catalogues price fixtures "Complete," i. e., the "BEARDSLEE SYSTEM." Original with us. The greatest improvement in catalogues in twenty years. Everyone now knows it. Our catalogue "S" is great when you want fixtures quick. We carry your stock. Shipped at once when you want them. Send us your orders.

No. 2450

BEARDSLEE CHANDELIER MFG. CO.

176-178-180 South Clinton Street, CHICAGO

"FIREFLY" FLASHERS



The most dependable and economical equipment for producing attractive flasher signs.

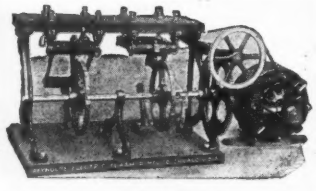
The Standard "Firefly" Flasher
will operate more than a single lamp. It is the old reliable Thermostatic Flasher, on the market since 1904. Large Platinum iridium contacts and no trouble from vibration.

The "Firefly" Flashing Socket
is a compact unit containing both flasher and lamp receptacle and may be readily adjusted to flash any size lamp, on 110 or 220 volts, D. C. or A. C. with the same instrument. Will flash 20 to 30 times a minute.

Write for Descriptive Literature and Prices

C. O. SCHNEIDER & CO., *Manufacturers*, 103 State St., Chicago

Patented Jan. 5, 1909, No. 908,679



Don't Be Satisfied

with second class Sign Flashers when you can get the genuine **New Reco**, the simplest, strongest and in every way the best flasher at the same or possibly a little less cost. Write today for prices, discounts, etc.

Reynolds Electric Flasher Mfg. Co.
Largest Manufacturers of Flashers in the World.
190 **Fifth Avenue** **Chicago**

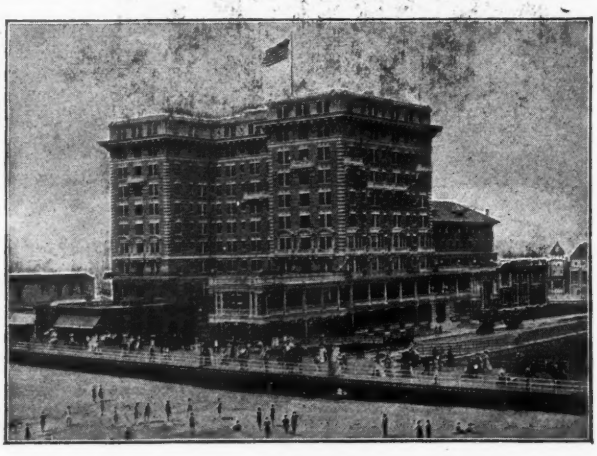
TUNGSTEN Lamp Machinery

Complete Plants Send for Catalogues

Premier TUNGSTEN Lamps

Pure Tungsten is not brittle [Ours are pure TUNGSTEN

DWYER MACHINE CO. - - Lynn, Mass.



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Sea water, as well as fresh water, in all bathrooms.

Special rates for N. E. L. A. on application to

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ALWAYS OPEN **ON THE BEACH**

Electric Signs

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Indestructible Lamp Coloring
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Original moving and display designs.

High-grade workmanship, prompt execution.

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New Federal Fixtures

No. 1100 Fixture

FOR USE WITH TUNGSTEN LAMPS

Write for new Bulletin No. 912, which gives complete information about several entirely new and distinctive types of Federal Tungsten Fixtures.

FEDERAL ELECTRIC COMPANY
LAKE AND DESPLAINES STREETS
CHICAGO

Visit Booth No. 24 at the Exhibition

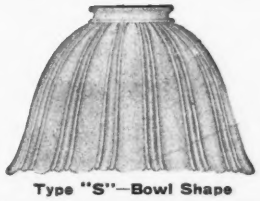
And See the New and Better Reflector for High-Efficiency Lamps—"OPALUX"

"OPALUX" Reflectors

The "Opalux" Reflector successfully answers the question: "How shall I get the utmost of illumination from my high efficiency lamps, at the place where I want it?"

Most reflectors waste current by massing it at a point where it is not required. The "Opalux" secures a proper distribution of Tungsten rays—in other words, a maximum of illumination at a minimum cost for current.

"Opalux" is a milky white glass, without glaze, with the diffusing surface on the reflecting side, and gives off warm, soft tints, entirely free from sharp contrasts in intensity.



Type "S"—Bowl Shape

3-Light "OPALUX" Fixture

Reasons for "OPALUX" Superiority

"Opalux" Fixtures save lighting bills, make high power lamps more efficient, send light where it is wanted. "Opalux" Reflectors have mechanical stability, are easily cleaned and have an artistic appearance. Write for booklet "N," which contains illustrations, descriptions, prices and discounts.

"Opalux" Tungsten Reflectors and Fixtures Are Carried by

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THE PRICE-McKINLOCK COMPANY, BOSTON, MASSACHUSETTS

"OPALUX" Fixtures

With the advent of expensive high-efficiency lamps, it becomes necessary for the dealer to follow scientific principles of illumination.

The manufacturers of "Opalux" have provided fixtures to go with their reflectors of a character so simple, yet artistic, as to harmonize perfectly with the general decorative scheme of their surroundings. The result is that the "Opalux" exclusive line of fixtures possess every essential requisite for ideal high-efficiency illumination at a minimum of cost.

Cooper Hewitt Lamps

For Alternating and Direct Current Circuits

Type K—Direct Current

Type H—Automatic Lighting—
Direct Current

Type F—Automatic Lighting—Alternating Current

Cooper Hewitt Light Sharpens the Sight

It is as good as a pair of strong glasses. Many regular wearers of glasses throw them aside entirely when working under Cooper Hewitt Light. This may seem incredible, nevertheless it's a fact. Cooper Hewitt Light makes every fine detail stand out sharply and distinctly. It does all this absolutely without injury to the eyes, and at a current cost one-half that for arcs or tungstens and one-fifth that for incandescents.

Ask for Catalogue No. 100

Cooper Hewitt Electric Company

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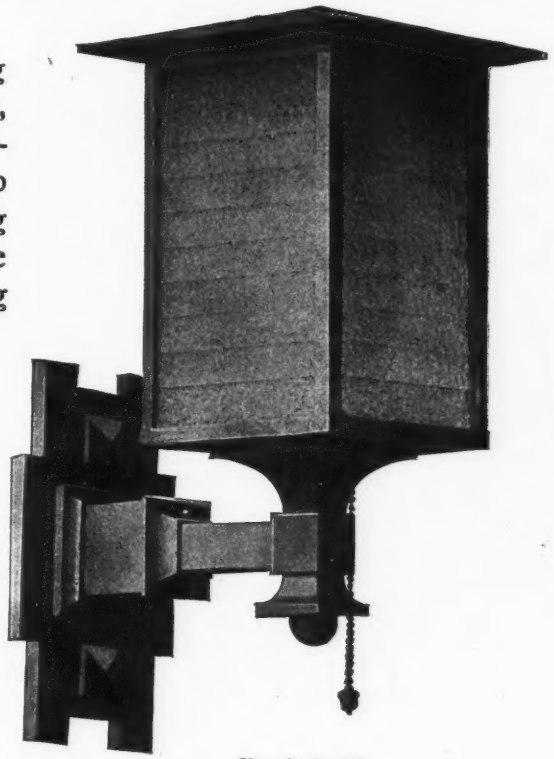
Now Ready

WE WILL BE PLEASED TO SEND YOU

CATALOG 15

A new and interesting volume of lighting lore, illustrating a line of up-to-date Tungsten Lamp methods of lighting effects, etc., which we sincerely trust will bring results.

Sent on application to the trade. Of exceptional interest to progressive dealers everywhere.



No. D 2347

Artistic and efficient fixtures for interior illumination.
A distinctive line of high quality at right prices.
Let us send you full details and literature. Write us now.

R. Williamson & Co.

WASHINGTON AND JEFFERSON STREETS

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MANUFACTURERS OF

Electric and Combination Fixtures and Art Domes

THE

REGENERATIVE FLAME LAMP

A Radical Departure from the conventional methods of Construction

THE MOST EFFICIENT ARC LAMP IN EXISTENCE

Carbons are placed vertically and will burn 70 hours per trim. Long carbon life is secured by the regenerative attachment, which is a special feature of the A-B Flame lamp and not found in any other make. It also serves to increase the volume of light produced.

The lamp mechanism is simple and rugged, insuring a minimum of expense for repairs.

Orders and inquiries to date prove the universal demand for and widespread interest in a lamp of this type—namely, an all-around flame lamp, suitable for either inside or outside lighting, with long carbon life and high luminous efficiency. Being provided with both inner and outer globes there is absolutely no escape of smoke or gases.

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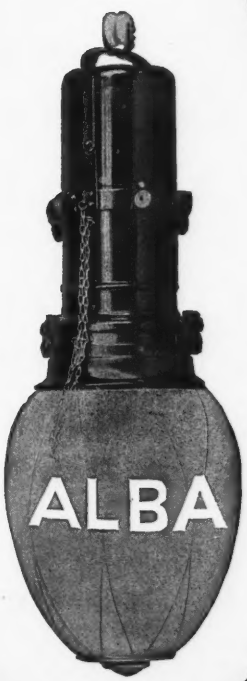
The FLAMING ARC LAMPS which have WON the CONFIDENCE of the Conscientious, Critical, BUYERS.



Alba (Vertical Flame Carbons) for broad distribution

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Should Receive the Excello Arc Lamp Company's Bulletins Every Month

If your name is not on our mailing list you are basing your comparisons of Flaming Arc Lamps upon last year's results. The 1909 **EXCELLO** is as far ahead of the 1908 model, as the 1908 **EXCELLO** is ahead of the rest of the field. Our Bulletin No. 101 tells **how** and **why.**

WHEN YOU BUY AN **EXCELLO** TODAY YOU KNOW THAT A YEAR FROM TODAY YOU WILL STILL HAVE THE BEST FLAMING ARC LAMP THAT MONEY CAN BUY.

You will never have to figure on the "scrap" value of an **EXCELLO.**

The Excello Arc Lamp Co.

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We have not had a single complaint on the air-tight flat grind of our NOBLAC Inner Globes since we Instituted our Vacuum Test on this work over two years ago.

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The FOSTORIA Glass Specialty Co.

MAKERS of GLASS and SCIENCE

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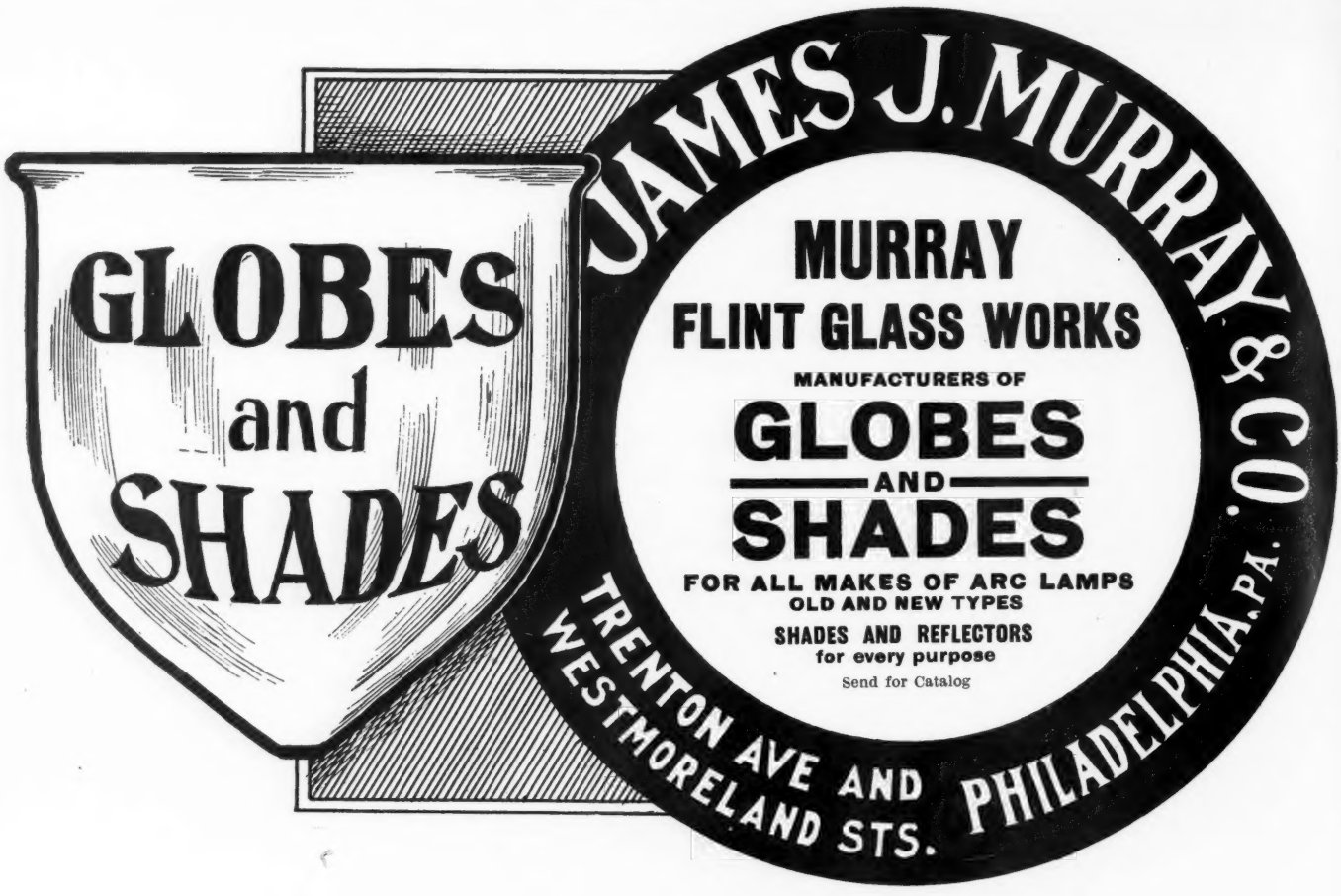
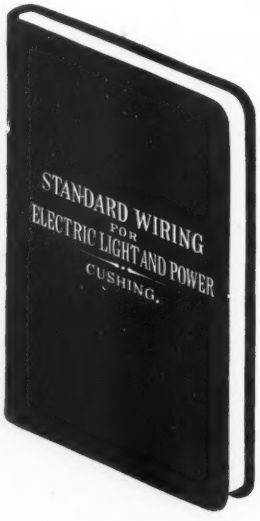


OVER 150,000 SOLD



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CATALOGUE B, showing many different designs, will be mailed on request.

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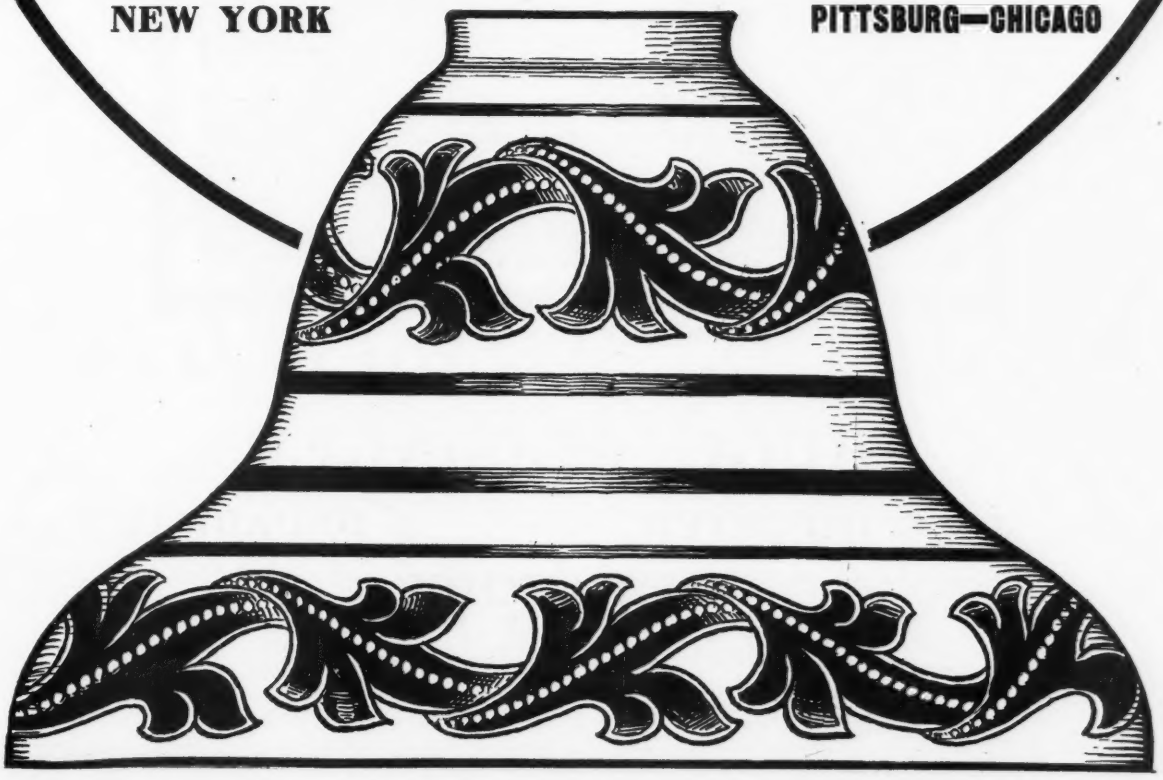

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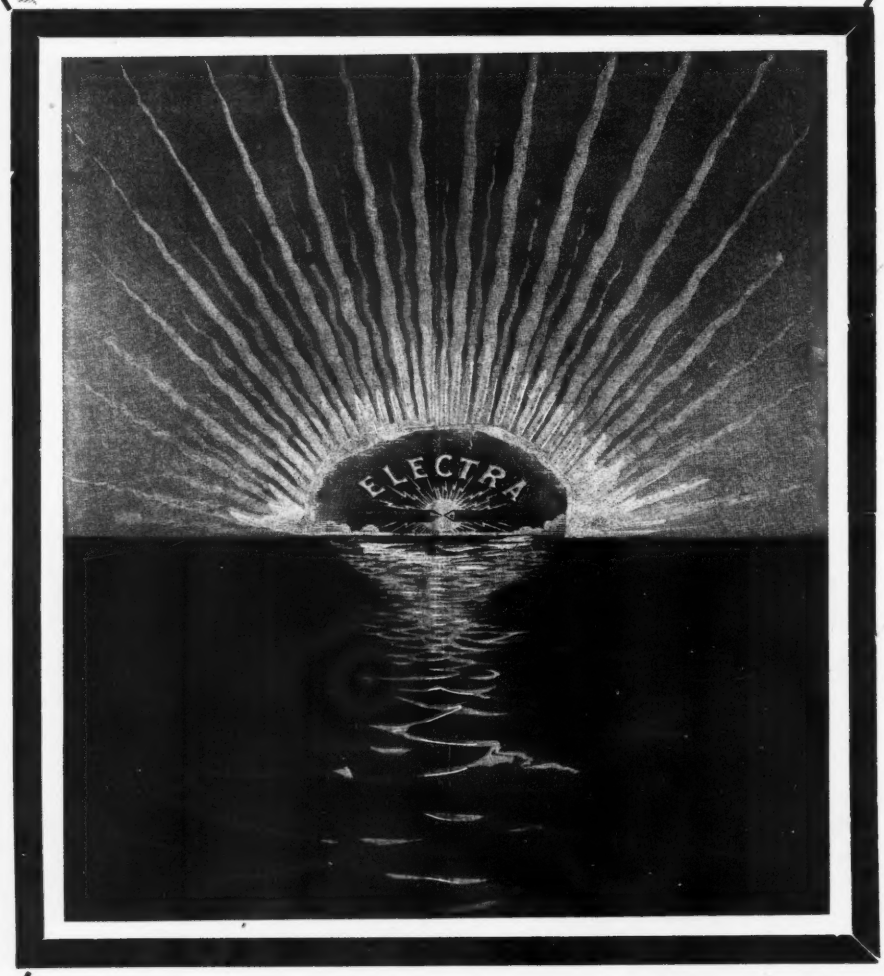
"ELECTRA"



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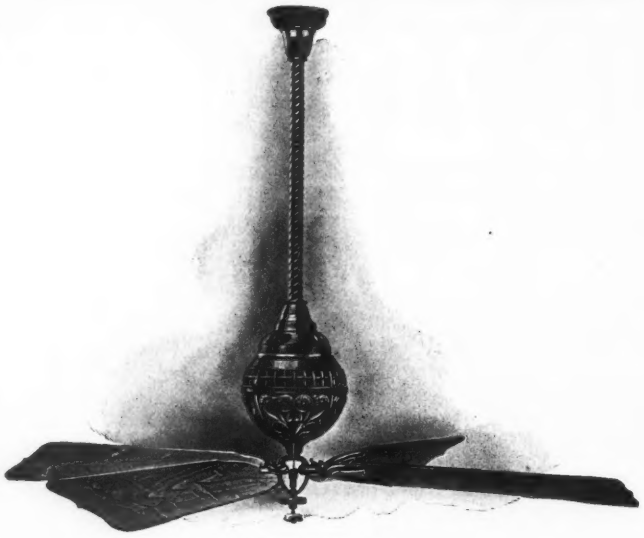
"WARD LEONARD" RHEOSTATS, etc.

WE HANDLE ONLY THE BEST IN OUR DIFFERENT LINES



"TUERK," Type A

"TUERK," Type A with electrolier

ORNAMENTAL DESIGN—ALTERNATING CURRENT

"TUERK" Fans Know No Equal and Are Second to None

The different designs of "TUERK" Fans are well known among the trade and public.

Each fan is made with care and with first-class material and workmanship.

It is best to place your orders now. Our 1909 descriptive fan catalogue sent upon application.

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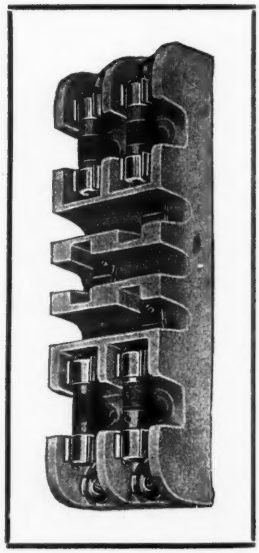
IN THE MIDST OF CONFUSION

You Will Find Us at the Old Stand Serenely Furnishing Good Fuses



The outside appearance your own judgment can decide.

The inside construction we have very carefully tested in every way.

You take no chance with fuses bearing this

trade mark.

CHASE-SHAWMUT CO., NEWBURYPORT, MASS.

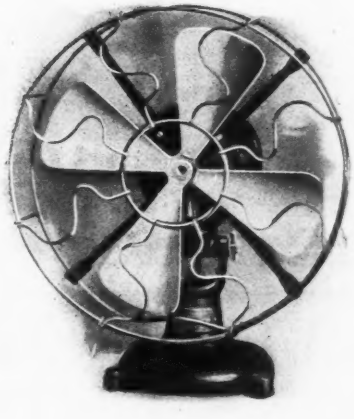
1909 Models

COLONIAL FANS

The most widely popular of all electric fans. Every season more in demand, every season a better investment for the Central Station.

The smooth running and unvarying efficiency of Colonial Fans are among the many qualities that commend them to discriminating fan-users.

As to durability, we don't know if they'll last forever—we have no figures from eternity, but we do know that they will bring good durable dollars into the coffers of the Central Station Man.



Let us quote you on your requirements. All types. Prompt deliveries

THE COLONIAL FAN & MOTOR CO.

WARREN, - - OHIO

Direct-Current Motors, Generators, Exhaust Fans, Rotary Converters, Motor Generators

Patented
July 2, 1907

In the Cam Bigger Fan

your best weapon is

As a business booster this device has no peer. It restores the discarded fan to service and current-selling usefulness. It makes the new fan more salable. It eliminates the one great drawback to the general use of electric fans—the unhealthy draft produced by the ordinary stationary fan.

Live dealers everywhere are stocking up with Simplex Oscillators and selling them like hot cakes.

The weather is helping.

Now is the time to get your orders in.

Don't delay!

Prompt action now will result in big PROFITS later in the season. The dealer will increase his fan sales, and the Central Station man as well will find the Simplex Oscillator a winner, and a big help in current-selling.

The season's output is fast being spoken for. We can fill your orders now, later on may not be able to.

The

New York, West St. Bldg.

Factory—

1905 EDITION AUTOMOBILE EDUCATOR Up-to-Date A Trouble Saver

This new revised work, which has been prepared to meet the increasing demand for a thorough treatise on the subject of motor carriages, cannot fail to have a wide circulation and prove of immense value to all persons interested in the subject. In the course of the 672 pages it presents all the important elements of automobile construction in clear, concise and popular language, readily comprehensible to any reader, but at the same time goes into all matters with a thoroughness that renders it a useful handbook even to skilled engineers and machinists.

As to the method of presentation, one remark is in place: Since the advent of the motor carriage has created a widespread interest in matters mechanical, bringing many persons who lack previous acquaintance with the mysteries of engine --struction and operation into intimate daily contact with practical problems and situations, it is essential that such a treatise as the present one should give the facts with as few technical terms as possible. In this respect the best book on the subject is somewhat like the best automobile carriage—the simplest.

The treatise on the gasoline engine cannot fail to prove valuable to anyone interested in explosive motors, which are daily coming to the front as the readiest and most convenient source of power.

The price of this popular edition is $2.00, postpaid, and as an insurance against accidents, caused by ignorance of the principles of operation—of which there are a lamentable number recorded every day—no one interested in the subject can afford to do without a copy of this timely volume.

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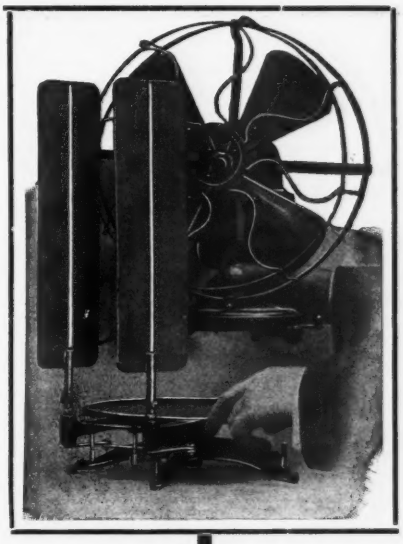
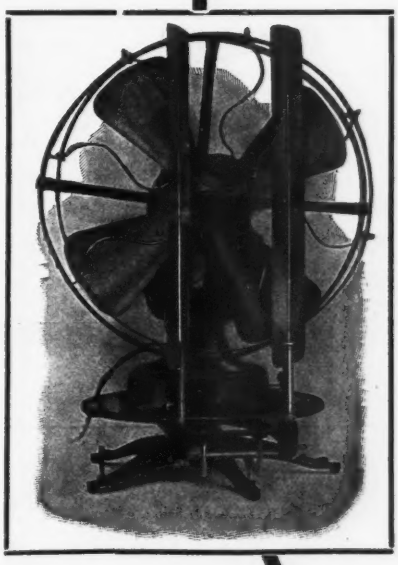
paign for a Business

the Simplex Oscillator





Any stationary fan may be transformed into an oscillating fan of the highest efficiency by the simple adjustment of fan to oscillator

Manifestly the value of the fan is increased to an extent equal to the difference in value between an ordinary stationary fan and a high-grade oscillating fan. Its salability is increased to the same extent.

There are lots of dead fans in every Central Station man's territory. They are unused and profitless, and their idleness helps to put the balance on the wrong side of the ledger.

Let us help you to put it on the right side. Use the Simplex Oscillator as a business booster. It will restore every one of those dead fans to active service, and as the humidity rises in the sweltering days to come your NET PROFITS will rise with it. Your customers will be better satisfied and more inclined to use electric current.

May we quote you prices? Let us demonstrate to you our ability to increase your NET PROFITS. Our proposition is fair. Write now.

Simplex Mfg. Co.

Chicago, Manhattan Bldg.

Thompsonville, Conn.

PRACTICAL ILLUMINATION

BY J. R. CRAVATH and V. R. LANSINGH

This book, dealing with the lighting of interiors by artificial means, supplies much of the needed specific data for carrying out in practice the principles that should be followed in the design of this work. Most of the information presented is of such a nature as to be valuable for the technical man, and read and applied with profit by the general public as well.

The apparatus for the production of light is not taken up, but the utilization to the best advantage of the light when produced is treated very thoroughly. Many tables of reliable and unbiased tests giving information on the light distribution of various illuminants with different globes, shades and reflectors are here published for the first time, so as to be available to the engineer. A large part of the book is given largely to illustrations of various lighting arrangements, with discussions of their desirable and undesirable features. The method of treatment throughout the book has been to illustrate principles, first by specific practical examples and then from these to point general conclusions.

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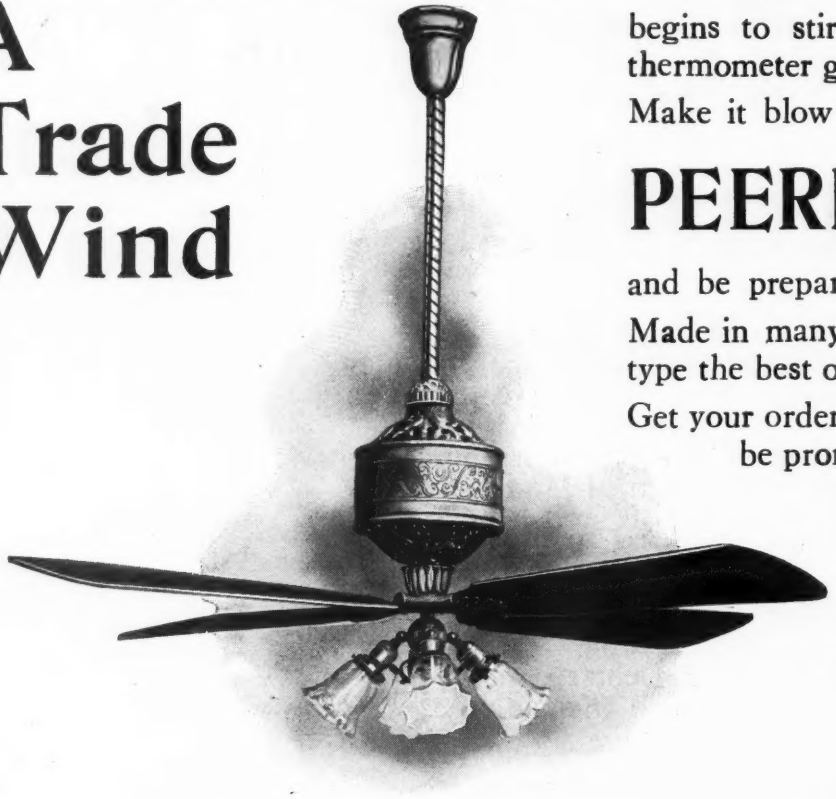
A Trade Wind



begins to stir in the Fan World as the thermometer goes up.

Make it blow your way! Stock up with

PEERLESS FANS

and be prepared when the rush comes.

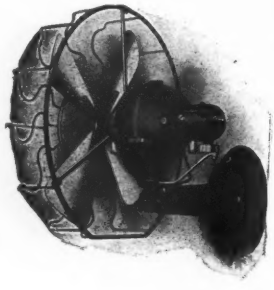
Made in many types for many uses. Every type the best of its class.

Get your orders in now and deliveries will be prompt. We can't promise what may happen when the rush comes. *Write now!*

The PEERLESS ELECTRIC CO.

WARREN, OHIO

Direct-Current Motors and Generators



FANS FOR EVEYBODY EVERYWHERE

Sprague Electric Fans

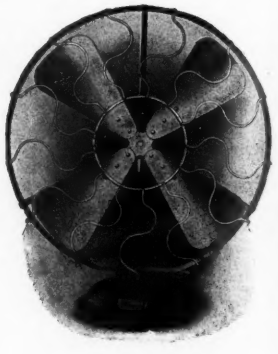
Are Sure to Please Your Customers

Our line of fans is intended to meet all requirements of location. Our fans do not consume an excessive amount of current; they run quietly and require no attention —except to oil once a season.

Have you investigated the remarkable merits of our new

Oscillating Fan

It is miles ahead of all others.



FANS FOR SATISFACTORY SERVICE

Moreover, the oscillating mechanism can be purchased separately and attached to the Lundell non-oscillating fans of the 1909 type.

Write for Descriptive Catalogue 3206

SPRAGUE ELECTRIC COMPANY

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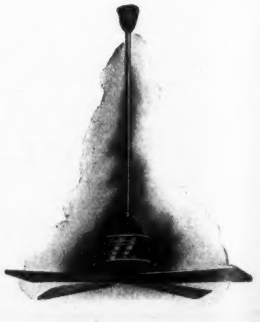

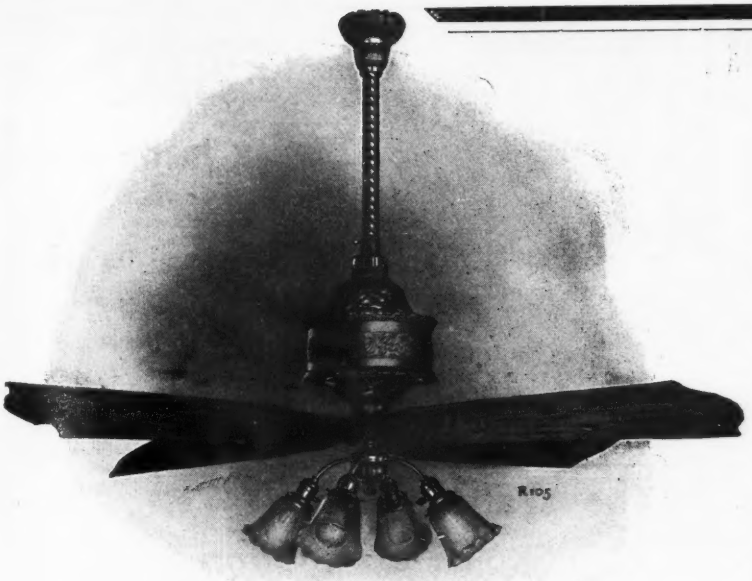

The Style "C" Ceiling, with Electrolier

Robbins & Myers "STANDARD" Ceiling Fans

Mechanical perfection of construction combined with artistic beauty—the distinguishing features which make our line of Ceiling Fans notable.

Style "C" is our leader both in efficiency and in beauty of design, its graceful lines and fine finish making it a desirable addition to elegantly finished interiors.

This fan has a remarkable popularity due to its splendid working qualities, fine construction and relatively low price. Designed for Direct-Current Circuits.

Our "Standard" literature is attractively prepared, and we will be glad to furnish you with descriptive matter relating to our line of D. C. and A. C. ceiling, desk, bracket, oscillating and exhaust fans.

We help you by magazine advertising, booklets, window cards, newspaper advertisements, etc. Get our plan. It means better business for you.

Complete stocks are in all our branches ready for immediate shipment.

THE ROBBINS & MYERS COMPANY

MAIN OFFICE AND FACTORY: 1319-1419 LAGONDA AVE., SPRINGFIELD, OHIO

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NEW ORLEANS, 312-314 Carondelet Street HOUSTON, Tel. Elec. Co.

Emerson Fans Shipped Promptly!

Large stocks of Emerson and Trojan desk and ceiling fans (for alternating current) are now on hand for prompt shipment in the following cities:

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San Francisco, California,	Western Electric Company
Jacksonville, Florida, -	Florida Electric Company
Atlanta, Georgia, - -	Carter & Gillespie Electric Company
Savannah, Georgia, - -	Electric Supply Company
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Toledo, Ohio, - - - -	Toledo Electric Company
Philadelphia, Pennsylvania,	H. C. Roberts Electric Supply Company
Pittsburgh, Pennsylvania,	Doubleday-Hill Electric Company
Nashville, Tennessee, - -	Southern Electrical Company
Dallas, Texas, - - - -	Hobson Electric Company
Houston, Texas, - - -	Tel-Electric Company
Richmond, Virginia, - -	Tower-Binford Electric Company

Order from the point from which you obtain best service

The Emerson Electric Mfg. Co.

The L. & N. Decade Testing Set

This set is for **accurate work** in the location of faults, grounds and crosses, and for resistance measurements. The coils are adjusted to 1-20% in the ratio arms and 1-10% in the rheostat. It is a simple and accurate set to use, and includes full directions on the lid. The galvanometer is of our standard portable type and will stand a great deal of rough usage. Ask for general catalog describing this and other testing instruments.

We also make a complete line of A. C. and D. C. Standardizing Apparatus, Galvanometers, Resistance Boxes, Condensers and Temperature-Measuring Apparatus.

THE LEEDS & NORTHRUP COMPANY
4901 Stenton Ave., Philadelphia
(2)

QUEEN

Testing Instruments

For 30 Years the Standard

Used Throughout the World

Portable Testing Sets for Locating Faults, Measuring Resistances, Comparing E. M. F's, Checking up Voltmeters and Ammeters, Making Murray and Varley Loop Tests, Testing out Grounds, etc.

HIGH-GRADE PORTABLE METERS.

Send for Catalogues.

QUEEN & CO., Inc. Philadelphia, Pa.

The Hoyt Ammeters and Voltmeters for direct current are made in all sizes from 2½" diameter up to 8", and for all purposes for which there is a genuine demand. If you have not already sent for our Bulletin E. R., you should do so at once.

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PENACOOK, NEW HAMPSHIRE

New York Office: 1931 Broadway
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Manufacture SPRINGS of every description; SCREW MACHINE PRODUCTS up to ⅞-inch round, and will be pleased to quote prices on anything in these lines, on receipt of samples or specifications.

Catalogue Free on Request.

3

Accurate, Compact, Inexpensive

Voltmeters, Ammeters and Volt-Ammeters

Send for complete catalog

Louis M. Pignolet, 78 Cortlandt St., N. Y.

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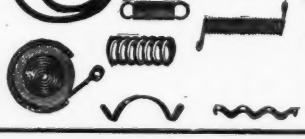

Manufacturers of WIRES and SPRINGS
For Machinery, Motors, Clocks, Music Boxes and every kind of electrical service
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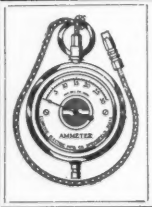

"QUICK TO USE AND ACCURATE."

"ECLIPSE" Battery Ammeters

0 to 30 Amperes

Testing your batteries saves lots of trouble. This indicates in EITHER direction. $3.00.

ELDREDGE ELECTRIC MFG. CO. (1)
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"Manross" HAIR SPRINGS

For Electric Indicating and Recording Gauges, Steam Gauges, Etc. Largest manufacturer of HAIR SPRINGS in the United States. Electrical Instrument Hair Springs are made from my Special Bronze Alloy

F. N. Manross, Established 1871 **Forestville, Conn.**

"Instruments That Never Forget"

—instruments which, installed upon your switchboard, will keep an accurate, permanent record of the operation of your plant—that means

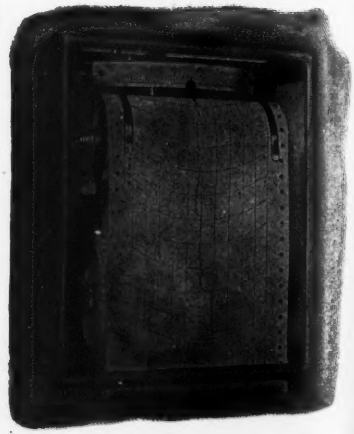
"Ideal" Curve-Drawing and Indicating Instruments

While giving far more reliable service than good indicating instruments, they cost but a trifle more. Made for all voltages, currents and wattages. It isn't at all difficult to find out about them.

Just write for Bulletin No. 125—Now.

Central Laboratory Supply Co., Lafayette, Indiana.

SEE EXHIBIT SECTION 17, NATIONAL ELECTRIC LIGHT CONVENTION, ATLANTIC CITY, N. J.



Ideal Curve-Drawing Instrument in operation.

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ENCLOSED FUSES AND BLOCKS

HAVE REACHED THE HIGHEST POINT OF PERFECTION

"Union" Fuses in actual use operate with satisfactory and unfailing accuracy, this accuracy being attained by twenty years' experience in the manufacture of fuses.

"Union" Fuses and Cut-outs are as perfect as mechanical ingenuity, the highest skill and best materials can produce.

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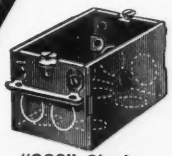
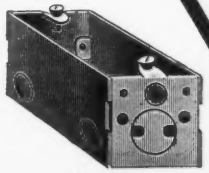
Accurate and Reliable under all conditions.

We manufacture every known type of fuse in any ampere, voltage and current capacity.

"UNION" SECTIONAL SWITCH BOXES, OUTLET BOXES AND COVERS



"CCS" Single



No. 170 Single

Patented April 2, 1907

Have a strong, substantial base, insures against breakage.

Contact Clips of Spring Bronze, made from dies which cannot vary, thus insuring perfect contact.

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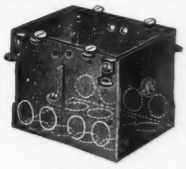
"AA" Single

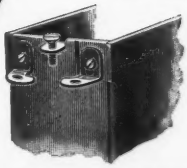
Takes all makes of Switches and Receptacles made from 14-Gauge Stamped Steel



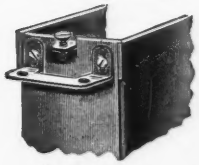
"AA" 2 Gang

Furnished in following depths:
2 in. "CCS"
2½ in. "CC"
2¾ in. "AB"
3 in. "AA"
3¼ in. "AC"
3½ in. "BB"

"AA" Spacer



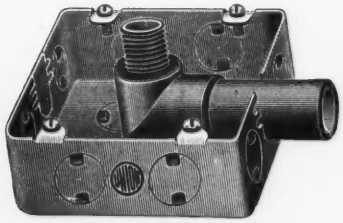
"F" Ear Regularly Furnished



"C" Ear

"SF" Ear

The above styles "C" and "SF" ears furnished only when specified.



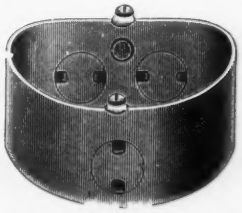
Box 101

103-J

Write today for Catalogue No. 23

Our Conduit Box Line is complete

103-K



Box 112

CHICAGO **CHICAGO FUSE WIRE & MFG. CO.** NEW YORK

McWilliams Metering Panel Board

(Patented May 4, 1909; Other Patents Pending)

Prevents Wasteful Use of Electric Light in Office Buildings.

Saves Current, Lamps and Generating Apparatus.

We can cite instances where the use of this Panel Board has made possible a reduction of over 40% in the operating load.

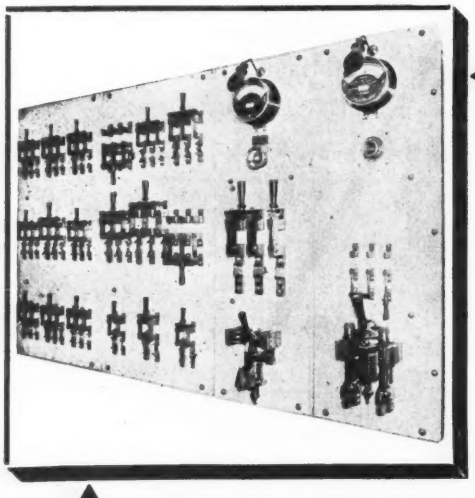
It greatly reduces the meter equipment.

A meter for every tenant instead of a meter for every room.

Manufactured by

THE J. LANG ELECTRIC CO.

117-128 No. Lincoln St., = = = CHICAGO



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Take no chances in buying your switchboard. You won't know whether you've gone wrong or not until long after it's paid for. You can eliminate every element of chance or uncertainty by coming to us, and our prices are right.

WRITE NOW FOR QUOTATIONS ON YOUR REQUIREMENTS.

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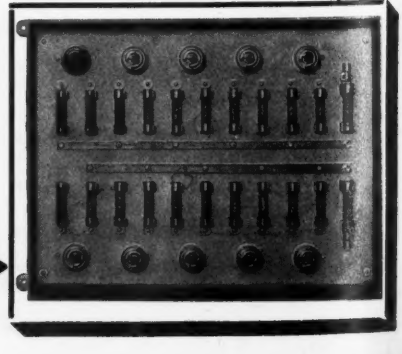
Are you particular about quality in your Panel Boards and Steel Cabinets, hard to suit, and generally dissatisfied with the articles supplied you heretofore? Are you looking for something better than you have had before? Panel Boards and Steel Cabinets that fulfill every essential of efficient service? If so, let us quote you on that next order. You simply can't find fault with ours. They have suited the most critical, they can fulfill your requirements. Write us about them.

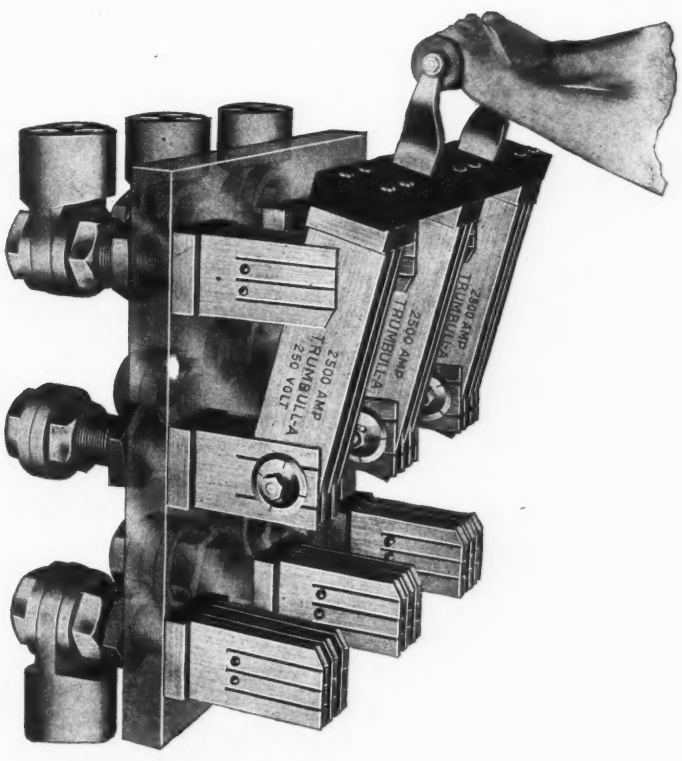
Eaton Electric Mfg. Co. 46 N. Carpenter St. CHICAGO



Trumbull Type "A" Switches

The *most* complete, most carefully constructed, best selling and most economical line of high-grade Knife Switches in the country.

Fidelity to Detail is the Secret of Switch Excellence



3,000 Amp., 3 P., D. T., B. C. "A" Switch.
(Contains 365 lbs. of pure copper.)

Get our General Catalog, our Stock Panel Bulletin and our Switch Board Bulletins Nos. 1 and 2, with prices.

Let us put you on the mailing list for **"Trumbull Cheer,"** our house organ which tells all about Trumbull material.

Trumbull Type "A" Switches are specified by the most exacting engineers and carried exclusively by the largest supply houses in the country, because they stand for superior quality in every point of detail, are reasonable in price, can be furnished promptly and all in all represent the standard Knife Switch of the country.

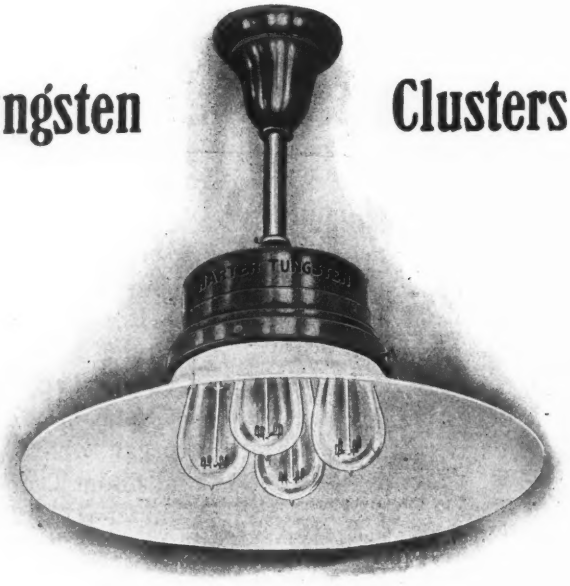
THE TRUMBULL ELECTRIC MFG. CO.

PLAINVILLE, CONN.

NEW YORK, 136 Liberty Street **BOSTON, 65 Oliver Street** **SAN FRANCISCO, 84-86-88 Second Street**

Everything Electrical

Tungsten Clusters

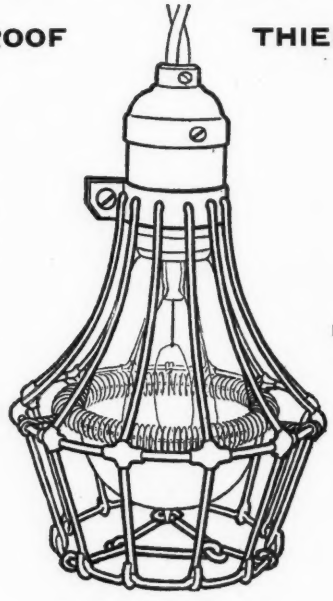


Write for Prices on Tungsten Fixtures.

MATTHEWS' HOLDFAST GUARDS

FOOL-PROOF THIEF-PROOF

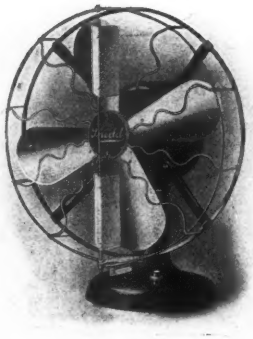
Putting on the Trap



Locking the Trap with pliers

The Guard with the Trap

Indorsed by all Fire Underwriters. Will fit sockets and all lamps up to 50 c. p. Made in four different weights. Made to Save Lamps.



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Complete Stock of Fan Motors of All Designs.

AGENTS FOR

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WESTERN AGENTS FOR CRESCENT INSULATED WIRE & CABLE CO. TRENTON, N.J. TRADE MARK

We carry large stocks and make prompt shipments at bottom prices.

Let us quote you on your requirements.

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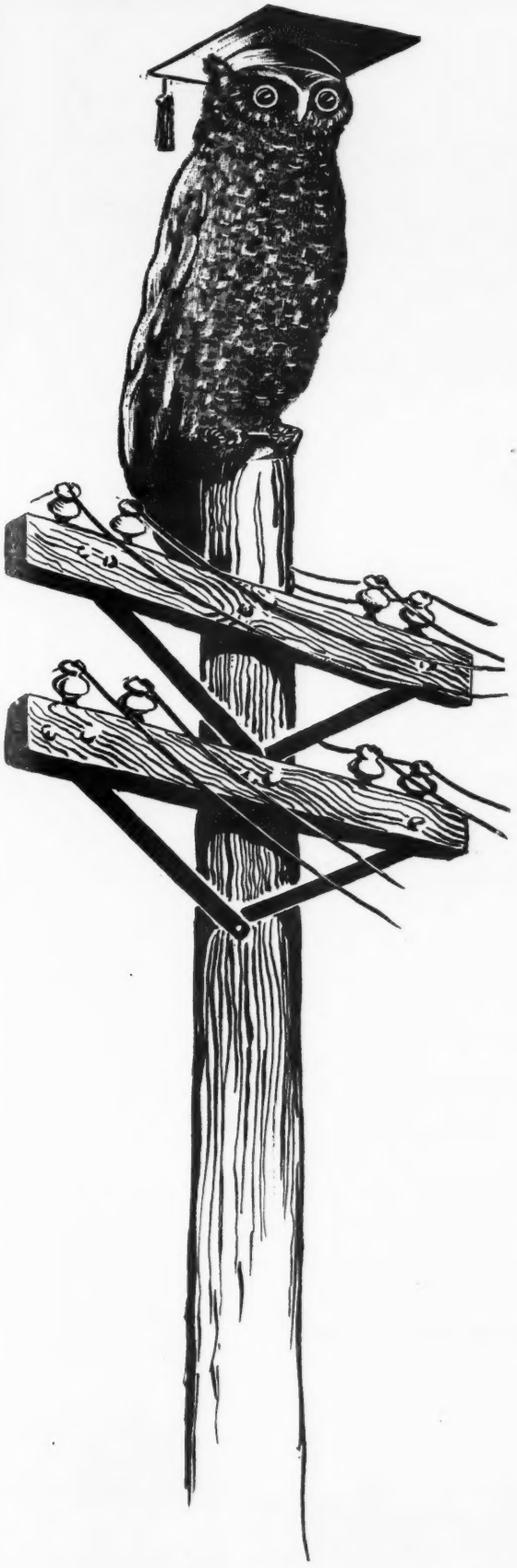


Want Something in a hurry?

IF YOU DO, WE CAN HELP YOU. WE ARE SPECIALISTS IN

QUICK DELIVERIES

ON EVERYTHING ELECTRICAL.

Suppose:

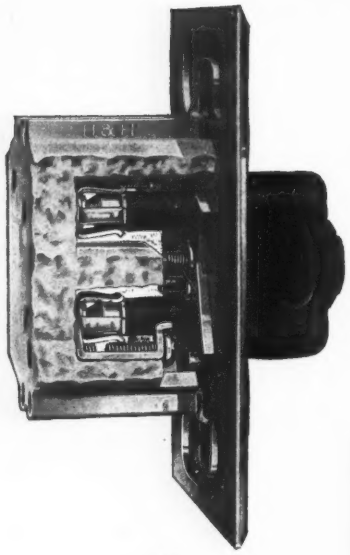
You are out of stock or there is something you MUST have immediately.

If so, Telephone, Telegraph or Write us.

We are centrally located; all railroads running out of Pittsburg have direct connections with the Terminal Warehouses. Our stock is large and complete, and for SPEED and ACCURACY our delivery system is the finest in the country.

Don't take our word for it, try us on your next rush order. We'll make good.

UNION ELECTRIC CO. Pittsburg Terminal Warehouses- PITTSBURG PA.



H & H SWITCHES

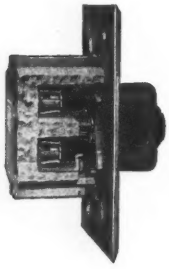
AND RECEPTACLES

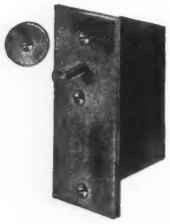
have a reputation built up by years of **satisfactory service** and have proven reliable under all conditions. Our line is the most complete in the country.
Have you had new prices on "H & H" material? If not see your jobber.

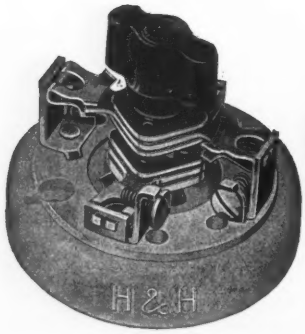
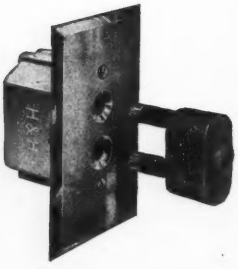
Catalog "F" is yours for the asking

THE HART AND HEGEMAN MFG. CO.

92 Capitol Ave. Hartford, Conn.





KEYLESS SOCKETS

KEY SOCKETS

PULL SOCKETS

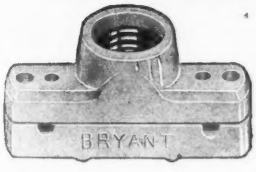
WALL SOCKETS

DO IT RIGHT!

USE

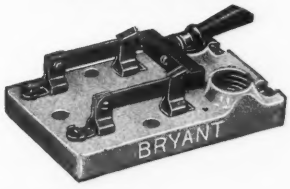
BRYANT
SUPERIOR WIRING DEVICES

RECEPTACLES



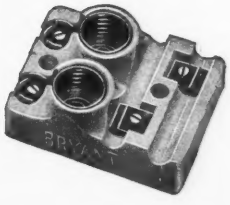
ROSETTES

KNIFE SWITCHES



SNAP SWITCHES

CUT-OUTS



FUSES

ATTACHMENT PLUGS

THE BRYANT ELECTRIC CO.

CHICAGO BRIDGEPORT, CONN. SAN FRANCISCO

THE PERKINS

"New Wrinkle"

Marks the acme of quality, design, finish and completeness of variety in socket construction

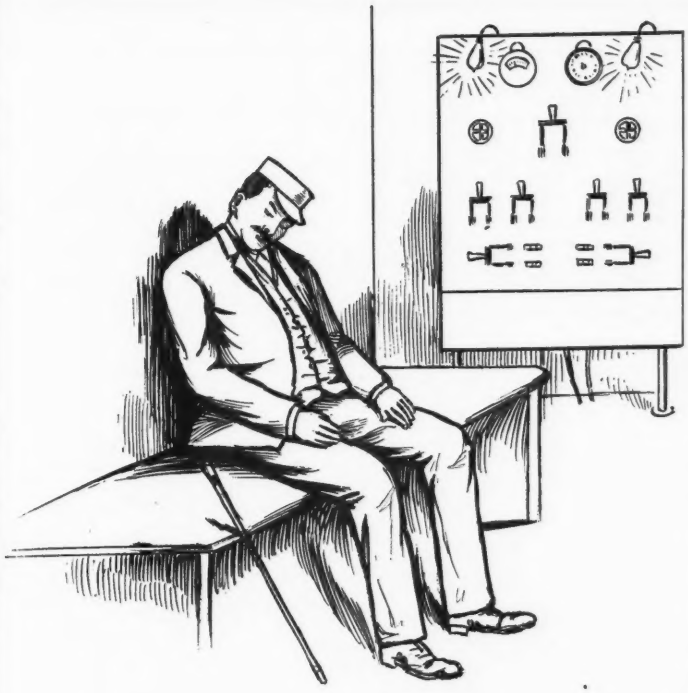
We make also a superior line of

Surface Switches
Flush Switches
Pendent Switches
Knife Switches

Rosettes
Attachment Plugs
Hanger Boards
Etc., Etc.

THE PERKINS ELECTRIC SWITCH MFG. CO.

Chicago **Bridgeport, Conn.** **San Francisco**



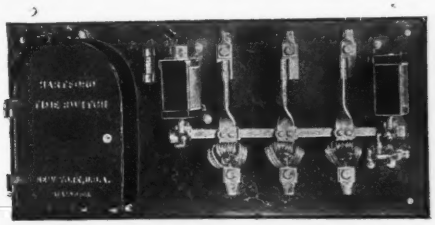
ASLEEP AT THE SWITCH

and the lights burn on, using current and wasting money. To err is human—why not put your dependence on an automatic switch that never fails to work. Always right on the minute. **Light and power cost money.** Why not control your current with the

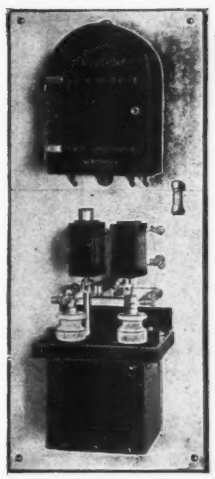
HARTFORD TIME SWITCH

It insures practical economy, turning on or off the power or light at any predetermined hour. Saves current consumption and reduces expense. Requires only weekly winding. For all voltages from 110 to 2,000. Sold under **DEFINITE GUARANTEES** covering every essential requirement. Approved by underwriters. Write for details.

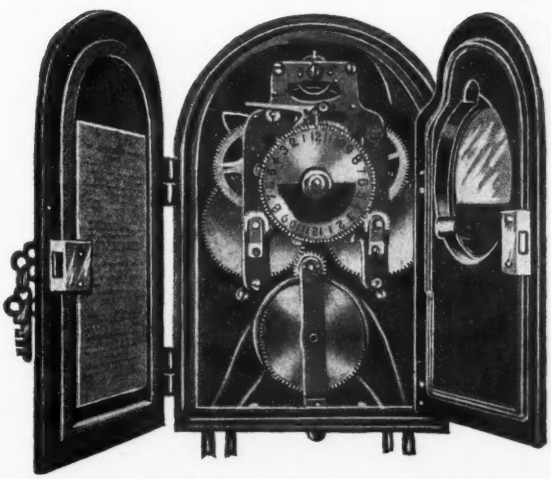
Illustrating 10 to 50 amp., Single and Double Pole, and 10 to 35 amp., Single, Double and Triple Pole Switch



Type L—Capacity 75 to 300 amp. 110-250 Volt A. C. or D. C.



Type H—15 amp., 2,500 Volts, Solenoid Opening and Closing Oil Switch.



Furnished 10 to 50 amp., Single and Double Pole, and 10 to 35 amp., Single, Double and Triple Pole.

Type "B" On and off daily at any predetermined hour. Provided with hand-trip and cut-out.

Type "C" Automatically makes device inoperative one day a week. Designed to omit operation on Sunday—or any other day.

Type "D" Similar to "B," but throws current on and off twice a day—booms things in time to catch the theatre crowds, for example.

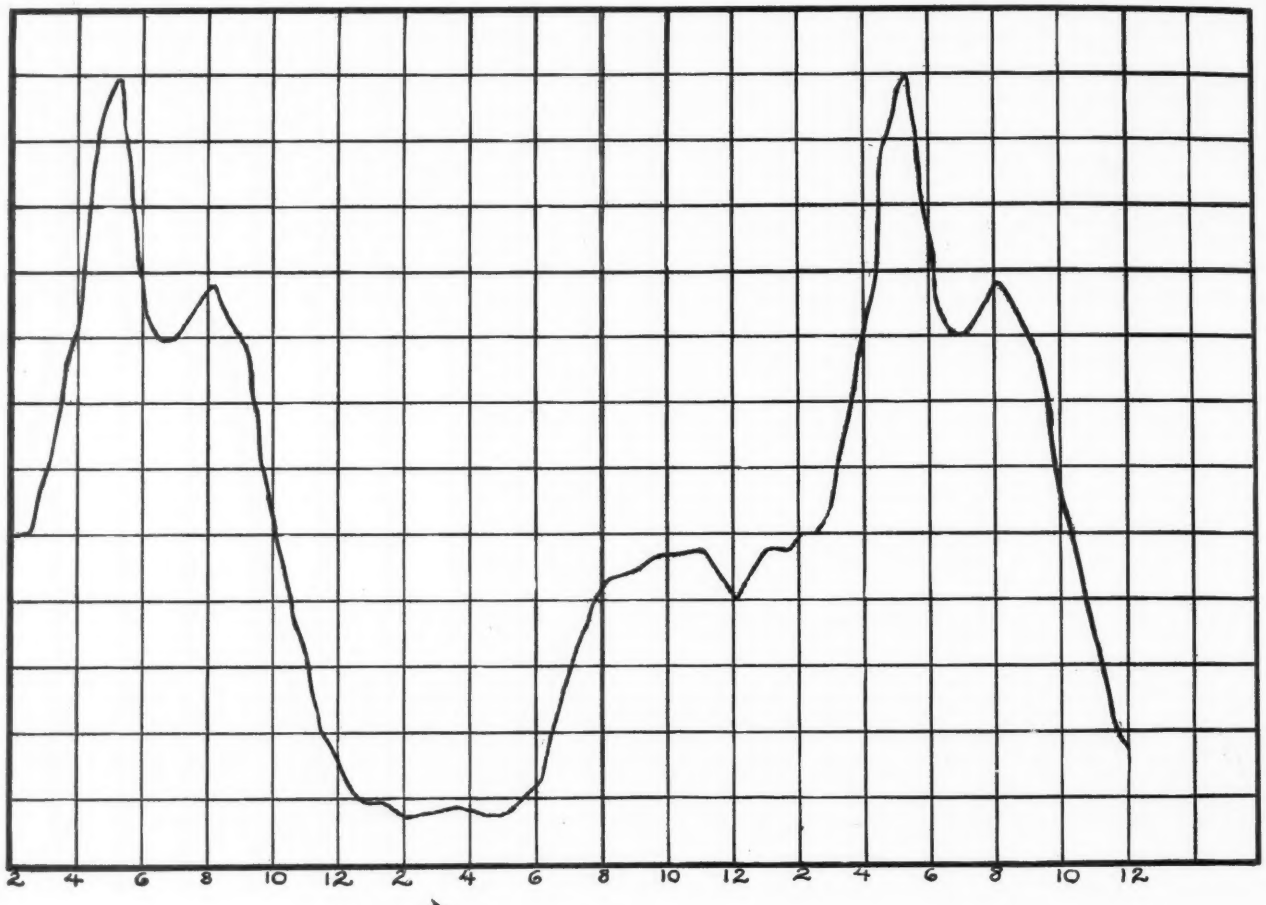
Type "E" For use with Two-Rate Meter Service. Automatically cuts from one meter to another at time desired.

Type "F" Controls isolated street lights.

Type "G" For apartment house hall lighting. Full number on, full number off. Night lights on, night lights off.

Hartford Time Switch Co.

95 Warren Street NEW YORK



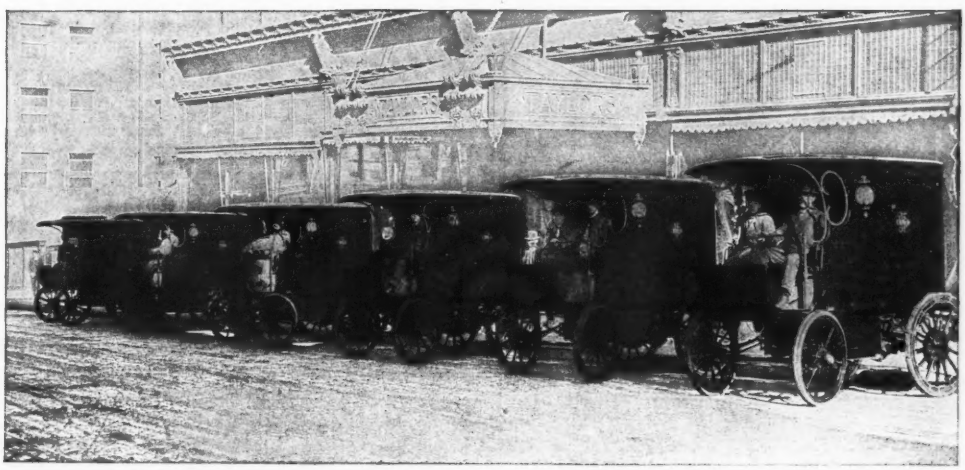
A sufficient number of electric automobiles on charge would do wonders for that gap.

The Columbus Buggy Company

Columbus, Ohio

SPACE 36, YOUNG'S PIER—N. E. L. A. CONVENTION

EVERY DAY YOU DELAY ELECTRIC POWER WAGON INSTALLATION YOU LOSE MONEY UNNECESSARILY. WE CAN PROVE IT.



JOHN TAYLOR DRY GOODS CO.

1034 TO 1040 MAIN ST. 1017 TO 1023 BALTIMORE AVE.

KANSAS CITY, MO February 27th, 1909.

Studebaker Bros. Mfg. Co.,
Automobile Department,
Kansas City, Mo.

Gentlemen:-

We are in receipt of your communication of recent date inquiring as to the results obtained from the six 800# delivery wagons purchased from you.

Replying will state that although these wagons were put in service at the most inopportune time of the year when our deliveries were heaviest and the Kansas City hills were covered with ice and snow, they have met and overcome these difficulties to our entire satisfaction.

While we appreciate the fact that better economies could be obtained by the installation of the entire equipment of ten wagons recommended by you as being the proper equipment for handling our delivery service, our experience so far demonstrates the fact that they only require the supervision of a man who understands their care and operation to make them a success.

We have no hesitancy in stating that we would not consider a proposition to return to the horse drawn vehicles.

Yours very truly,

JOHN TAYLOR DRY GOODS CO..

FAT-K By John A Taylor Pres

Studebaker Automobile Company

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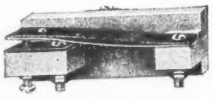

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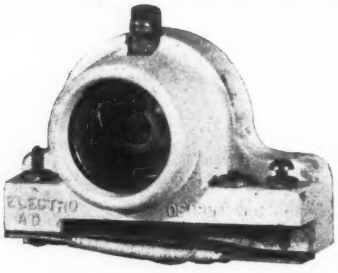

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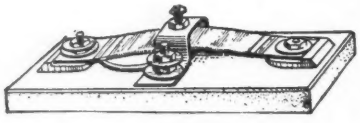

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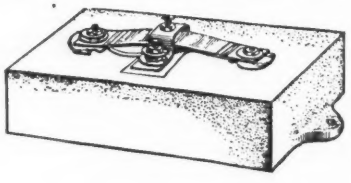

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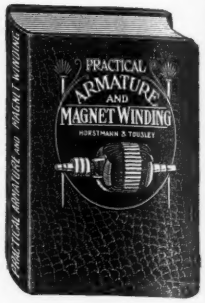

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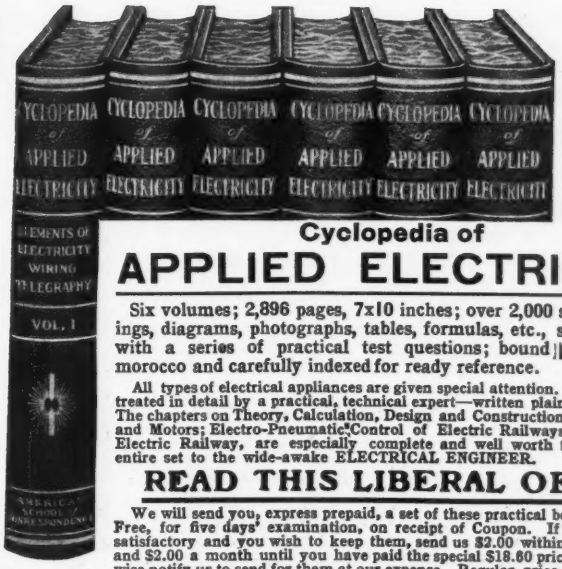

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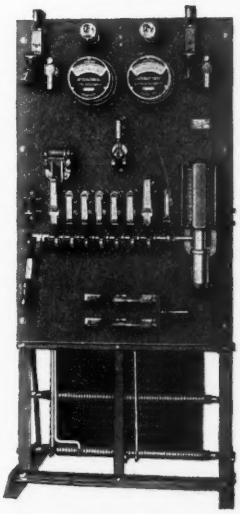

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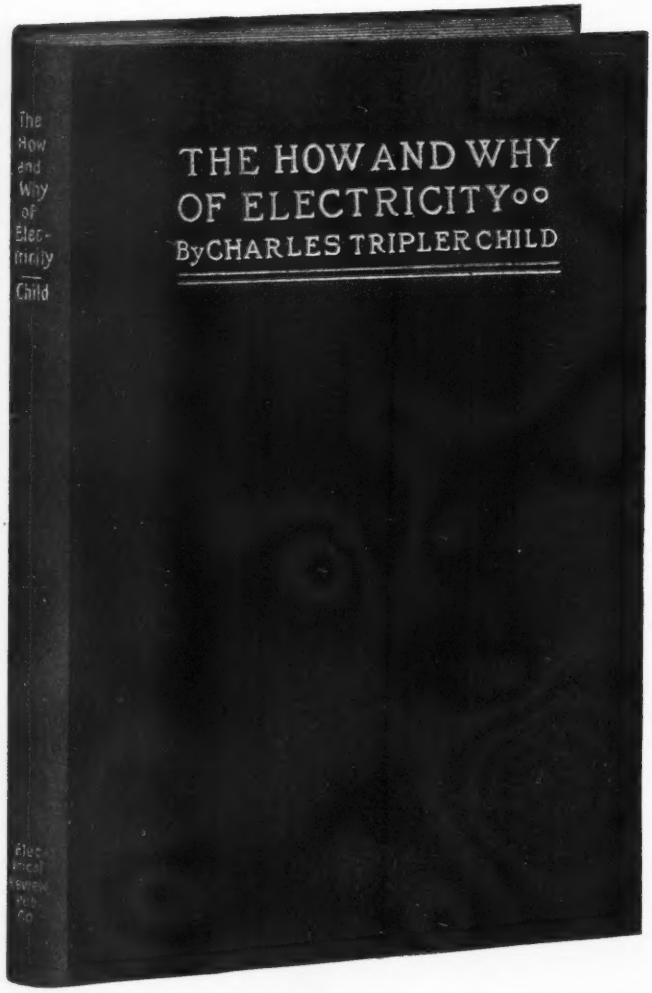

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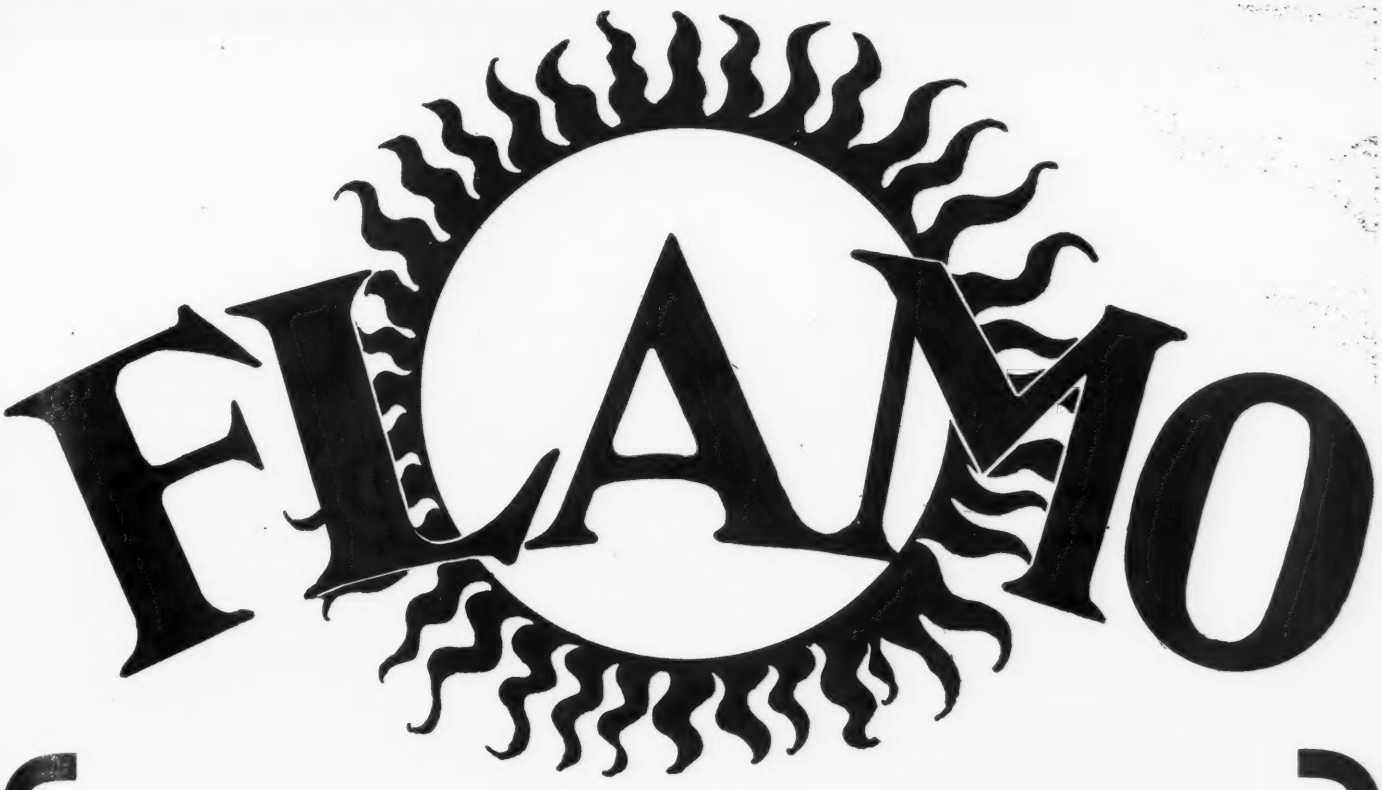

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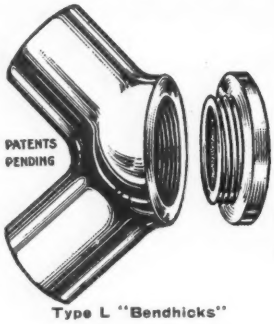

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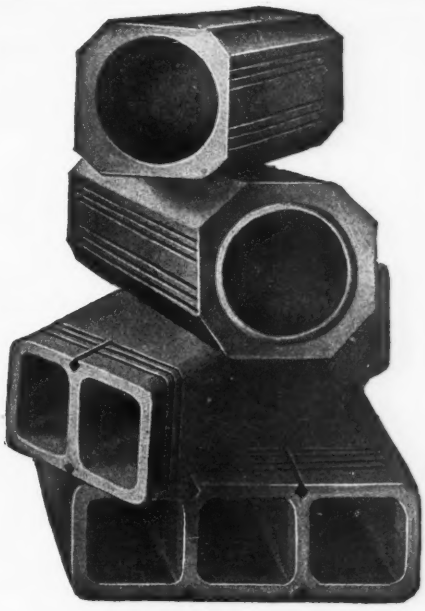

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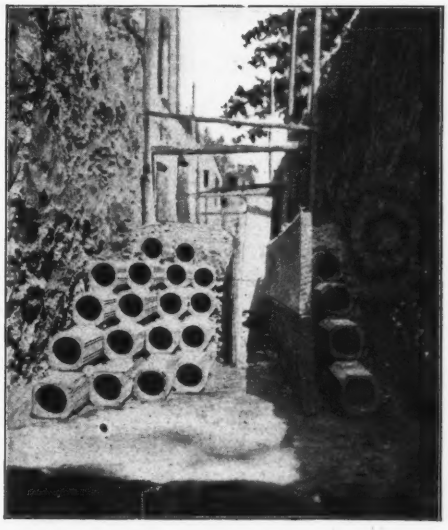

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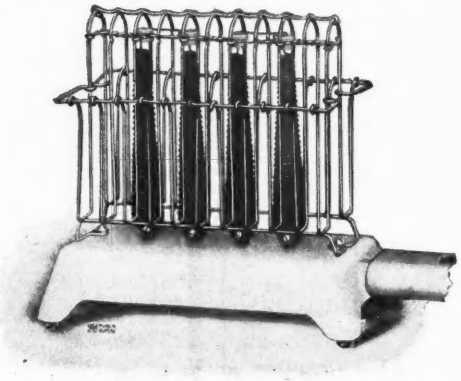

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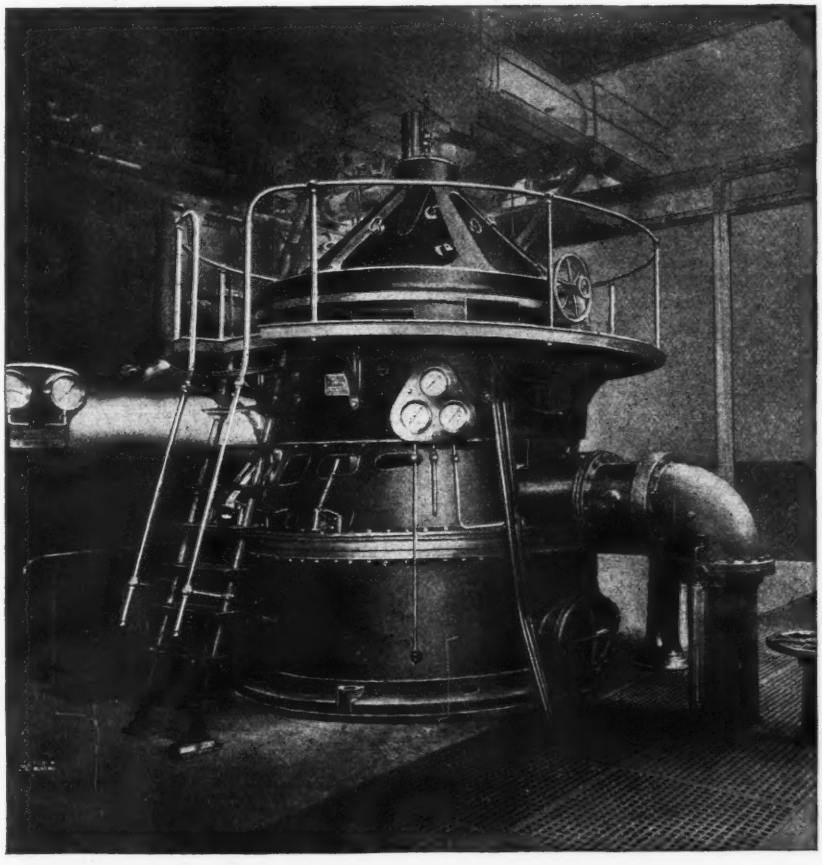

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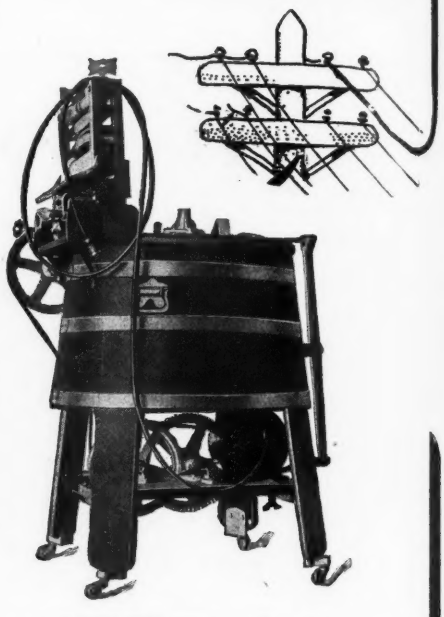


Write for our novel proposition

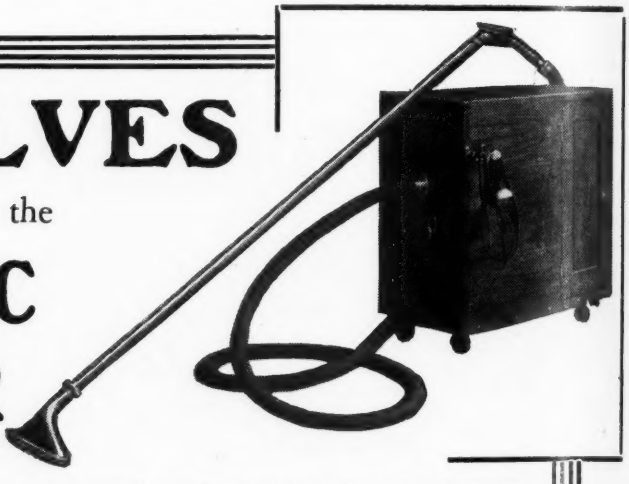
AUTOMATIC ELECTRIC WASHER CO.

NEWTON - - - IOWA

It has NO VALVES

that's only one of a dozen good reasons why the

POSITIVE ELECTRIC VACUUM CLEANER



is the Best of all Electric Cleaners. Another is that it has only one gear, is substantially constructed and absolutely *foolproof*. Simplicity of design, smoothness in running and entire dependability are among the qualities that commend it to the user.

For the Central Station man it is a Business Booster and a Current Seller of the first class. It fills a gap. The surplus current that so often serves to put the balance on the wrong side of the ledger is utilized at a profit. Most important of all the consumer is satisfied—and a satisfied customer is an asset that no Central Station man will willingly lose. *Let us tell you more. Write for literature and prices.*

ELECTRIC CLEANER CO., 1657-8-9 Monadnock Block, CHICAGO, ILL.

See Our Exhibit at the National Electric Light Convention

American Bridge Company of New York

NATIONAL TUBE CO., LORAIN, OHIO.

STRUCTURAL STEEL FOR EVERY PURPOSE

General Offices, Hudson Terminal - - - - - - - 30 Church St., NEW YORK

YES WE DO CRATE AND SHIP

our patented "metal-clip wood cut-out box" to anywhere within 2,000 miles of Chicago, at a profit to both of us.

Write for Prices and Discounts

ASHLAND ELEC. CO., 195 W. Division Street CHICAGO, ILL.

WE MANUFACTURE

SINGLE-PHASE MOTORS

FOR ANY COMMERCIAL VOLTAGE, ANY FREQUENCY BETWEEN 25 AND 140 CYCLES, HORIZONTAL, VERTICAL, AND BACK-GEARED TYPES. THEY ARE SELF-STARTING UNDER FULL LOAD. ¼ TO 15 H. P.

CENTURY ELECTRIC CO.

19th and Olive Streets ST. LOUIS, MO.

COMMUTATOR INSURANCE

That's what we offer, for there's no friction or wear with these brushes.

Being 90 per cent pure graphite insures low resistance, no sparking under varying load, longer wear and no greasing.

HOLMES FIBRE-GRAPHITE MFG. CO.

GERMANTOWN, PHILADELPHIA, PA.

National Code Standard. 6 Amp.—250 V.

"PATTERSON"

FLOOR BOX AND RECEPTACLE

No. 3000

List price, $4.00—Discount, 50%. The quickest cut in Floor Box made.

Try the "PATTERSON" *once* and you'll always specify it.

At all Jobbers, or of the manufacturers.

STANLEY & PATTERSON

23 Murray St.—27 Warren St. New York, U. S. A.

SACHS Enclosed Fuses and Cut-Outs are Safe, Sure and Accurate

They are not thrown together to look the part without other consideration, but are the perfected result of over 15 years of Enclosed Fuse Experience, properly designed and constructed, and embody features which make them superior to all prior efforts.

Innumerable features of superior construction, result in the practical attainment of perfection in

Be Sure to Note the Trade Mark

It Stands for the Best in Enclosed Fuses

Protective Appliances for Any Voltage
The Best and yet the Most Reasonably Priced

Old and New Code Types
National Elec. Code Standard Fully Approved

THE SACHS CO Hartford, Conn. BRANCHES: New York Boson Chicago St. Louis San Francisco Los Angeles New Orleans Toronto, Can. London, Eng. 3

New WESTON ECLIPSE

Direct-Current Switchboards, Ammeters, Milli-Ammeters and Voltmeters

are of the "soft-iron" or "Electromagnetic" type, but they possess so many novel and valuable characteristics as to practically constitute a new type of instrument.

Their cost is exceedingly low, but they are remarkably accurate, well-made and nicely finished instruments and are admirably adapted for general use in small plants, the cost of which is frequently an important consideration.

Correspondence concerning these new Weston Instruments is solicited by the

Weston Electrical Instrument Company, Waverly Park, Newark, N.J.

List of Selling Agencies and Branch Offices

New York, 114 Liberty St.
Chicago, 1504 Monadnock Blk.
Philadelphia, 346 Mint Arcade.
Boston, 176 Federal St.
St. Louis, 915 Olive St.
Denver, 1725 California St.
San Francisco, 418 Eugenia Av.
Cleveland, 314 Caxton Bldg.
Mexico, Cadena 10.
Montreal, 13 St. John St.
Toronto, 6 Wellington St.
London, Audrey House, Ely Pl., Holborn.
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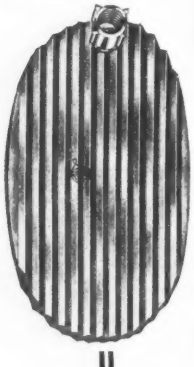
Paris, 12 Rue St. Georges.
(3)



DANGER!

Lightning means danger unless your lines are properly grounded. Digging down to permanent moisture is hard work, but once our

GROUND PLATE

is down it "stays put," and you are relieved of all anxiety on that score. Let us tell you about it.

LORD ELECTRIC CO.
213 West 40th St., NEW YORK
5-29-09

YOUR SWITCH LOVE

does not have to be interfered with to make up a Panel Cut-out for a Rotary Switch. These new Paiste Cut-outs take the new type single or double Pole Switches of ALL manufacturers. They are Paiste of course; just another of these specialties that make us "the leading specialty manufacturers."

Catalog No. 5190

"Paistery" (monthly) keeps you informed as to all new things. Do you get your copy? Let us know.

H. T. PAISTE, PHILADELPHIA, PA.
NEW YORK (3) BOSTON CHICAGO

Small Central Stations cannot

afford to maintain testing departments as do the larger companies. Their **Need** for such service is equally as great. Our **Testing Facilities** often serve the required purpose.

Write for our proposition to Central Stations.

ELECTRICAL TESTING LABORATORIES
80th Street and East End Avenue, NEW YORK, N. Y.

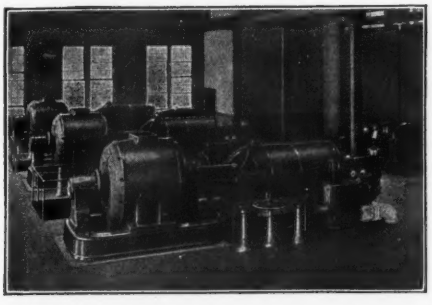
ALLIS-CHALMERS CO

BUILDERS OF

ELECTRICAL MACHINERY FOR ALTERNATING AND DIRECT CURRENT

STEAM TURBINES AND GENERATORS

In Capacities from 25 K. W. to 20,000 K. W.
STANDARD CONDENSING TURBINES

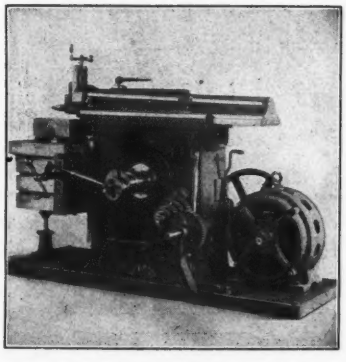


Three Allis-Chalmers Steam Turbines and Generators of 2,250 Kilowatts Capacity, on Normal Load

Non-Condensing and
Partially Condensing Turbines
Low Pressure Turbines

INDUCTION MOTORS

ALL TYPES ALL SIZES
FOR EVERY SERVICE

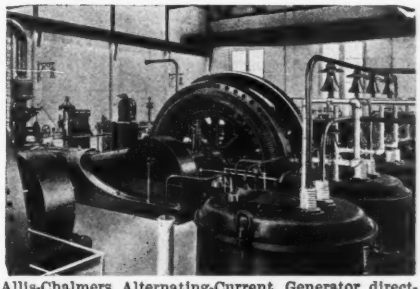


Allis-Chalmers Induction Motor Geared to Shaper

"Quality" is the index to their construction. In no case has efficiency, durability or operation at conservative temperatures been made of secondary importance merely to secure light weight and the "cheapness" commonly associated with it.

ALTERNATING-CURRENT GENERATORS

Revolving Field Type



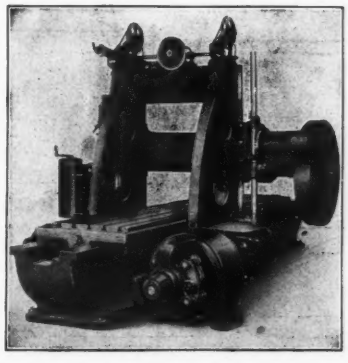
Allis-Chalmers Alternating-Current Generator direct-connected to an Allis-Chalmers Cross-Compound Engine

Our claims of these generators, whether belted or designed for direct-connection to Steam Engines, Water Wheels or Gas Engines, are based upon their actual operating record.

Send for a list of our installations in your vicinity.

DIRECT-CURRENT MOTORS OR GENERATORS

Type "K"



Allis-Chalmers Type "K" Motor, driving Slab Milling Machine

Our Type "K" Machines have been especially designed to meet the most exacting requirements of modern service.

RIGIDITY—COMPACTNESS

Large Bearings and Shafts of Great Stiffness.

GENERAL OFFICES—MILWAUKEE, WISCONSIN

POSITIONS WANTED

The rate for "Positions Wanted" advertisements of forty words or less is one dollar an insertion; additional words two cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 507 Marquette Building, Chicago, or 13-21 Park Row, New York.

POSITION WANTED—With electrical company where good work will win promotion. Have three years' experience in central power house as oiler and switchboard work tender. Good references. Address Box 1103, care of Electrical Review and Western Electrician, Chicago.

POSITION WANTED—By an electrical engineer, 33 years of age, eleven years' practical experience with three years' technical training. Want position as manager or superintendent of large electric light or power company. Thoroughly up-to-date on all modern electric and steam machinery. At present employed but wish to make change. West or middle West preferred. References. Address Box 1105, care of Electrical Review and Western Electrician, Chicago.

POSITION WANTED—As superintendent or chief engineer for a small electric-light or power plant by a sober young man with a technical education. Has had experience with steam turbines, engines and high-tension work. Will stand a watch, if necessary. Address P. O. Box 415, Gridley, Ill.

HELP WANTED

The rate for "Help Wanted" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 507 Marquette Building, Chicago, or 13-21 Park Row, New York.

WANTED—Men to take county rights. Nucleus for lifelong business. Electric floor-finishing machine that planes, grinds, sandpapers, oils and polishes. Glass surface—piano finish. Big money. Marvel for labor saving and beautiful workmanship. Easily operated. Address "JMC," care of Electrical Review and Western Electrician, Chicago.

WANTED—Experienced salesman to sell Incandescent Lamps. We make only Class A lamps, and none but A1 men need apply. Give age and reference in first letter. Address M. LAWRENCE, 115 W. 11th St., Erie, Pa.

WANTED—Experienced electrical instrument makers, also young men to assemble electrical work. Apply 45 Morris St., Jersey City, N. J.

WANTED—Salesman for insulated wires and cables. A prominent manufacturer is looking for an energetic man familiar with the electrical trade, contributary to Chicago, who can make good on a large proposition. Address, with complete information, Box O. W., care of Electrical Review and Western Electrician, Chicago.

PROPOSALS.

The rate for "Proposal" advertisements is 15 cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

THE CITY OF TORONTO, CANADA

Will shortly call for tenders for the laying of about 300,000 duct feet of underground conduit.

For specifications, apply to the Electrical Department, City Hall.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 507 Marquette Building, Chicago, or 13-21 Park Row, New York.

FOR SALE—Electric light plant operated by water power, low cost. Location, town 1,500 Central Ohio. New ten-year contract for street lighting, large commercial service. Paying investment; reason for selling, death. Address Box 1106, care of Electrical Review and Western Electrician, Chicago.

FOR SALE—One 75-kilowatt, 2,200-volt, 2-phase, 60-cycle, 720 R. P. M. Westinghouse Alternator and one 150-kilowatt, 2,300-volt, 60-cycle, 2-phase, 900 R. P. M. Stanley Inductor. Both machines complete with exciter, sliding base rails and rheostats. Address Eagles Mere Light Company, Eagles Mere, Pa.

FOR SALE—Water power grist mill. Healthy community on railroad. Good place for paper mill. Address Thos. M. Ferguson, Hattiesburg, Miss.

FOR SALE—Thirty 110-volt D. C. General Electric, Form 5, enclosed Arc Lamps, nearly all indestructible coil type. Will sell cheap. Address Hicksville Elec. Lt. Co., Hicksville, O.

WANTED—Second-hand equipment. One G. E. Type A. T. B., 60-cycle, 3-phase Generator, 125 to 150 kilowatts; one 18x36 or 42 Corliss Engine; one 72x18 ft. high pressure Boiler. Above must be A1 and cheap for cash. R. J. Tower Iron Works, Greenville, Mich.

PROGRAM CLOCKS

are a great modern convenience in schools, colleges and other large buildings where automatic signals are desired. By their use any number of different bells in any number of different rooms may be rung at any time desired during the day.

ALSO 60-DAY, ELECTRIC WATCHMAN'S, AND FRYING-PAN CLOCKS. Send for Catalogue No. 207.

The Prentiss Clock Improvement Co.
Dept. 20
92 Chambers Street New York City

WANTED

50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick

You who are Troubled with Sparking and Cutting of Commutators to Use
The only article that will Prevent Sparking. Will keep the commutator in good condition and Prevent Cutting.
Absolutely Will Not Gum the Brushes.
It will put that high gloss on the commutator you have so long sought after.
K. McLENNAN & CO.
Sole Manufacturers
Room 411, Inter Ocean Bldg.,
130 Dearborn St., Chicago, Ill

Peirce Steel Brackets
Peirce Expansion Bolts
Peirce Hammer Drill
PEIRCE SPECIALTY COMPANY
ELKHART, INDIANA.

ELECTRICAL INVESTMENT

$30,000 will purchase an established electrical supply business, with complete catalogue and first-class organization, located in Chicago; present owner unable to devote sufficient time for proper management. Lock Box 493, CHICAGO, ILL.

WANTED—Representatives in different localities to handle the well-known line of Reeves Compound and Simple Steam Engines, and Reeves-Graef Marine and Stationary, Gas and Gasoline and Producer Gas Engines. In answering write fully.

TRENTON ENGINE COMPANY, Trenton, N. J.

ELECTRICITY

THE BLISS ELECTRICAL SCHOOL is the oldest and best school in the world teaching ELECTRICITY exclusively. Theoretical and practical course complete

IN ONE YEAR Students actually construct Dynamos, Motors and Electrical Instruments. Graduates hold good positions in electrical industries throughout the world. Seventeenth year opens September 22. Apply for free Catalog to

LOUIS DENTON BLISS, President, 90 Takoma Avenue, WASHINGTON, D. C.

MOTORS and GENERATORS

NEW AND SECOND-HAND

LARGE STOCK

IF YOU DON'T KNOW WHAT YOU WANT, ASK

"JONES"

WE BUY WE SELL WE RENT

ARTHUR JONES COMPANY

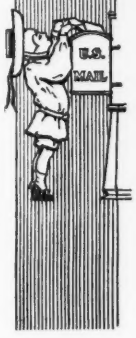
84 A Van Buren Street, CHICAGO

GREGORY ELECTRIC CO.

THE PIONEER ELECTRICAL BARGAIN HOUSE

OFFICES, WAREHOUSES & WORKS CORNER 16TH & LINCOLN STS. CHICAGO

SECOND HAND DYNAMOS & MOTORS



CAMPAIGN COMMITTEE
A.D. KUEHMSTED VICE PRES. & SALES MGR
J.D. ZOOK GEN. SUPT.
A.L. KUEHMSTED PRES. & GEN. MGR.
C.C. BESOLD SECRETARY
J.A. VINCENT ASST. SUPT.
REPAIR DEPARTMENT

SEND US YOUR NEXT REPAIR JOB AND GET COMPLETE SATISFACTION

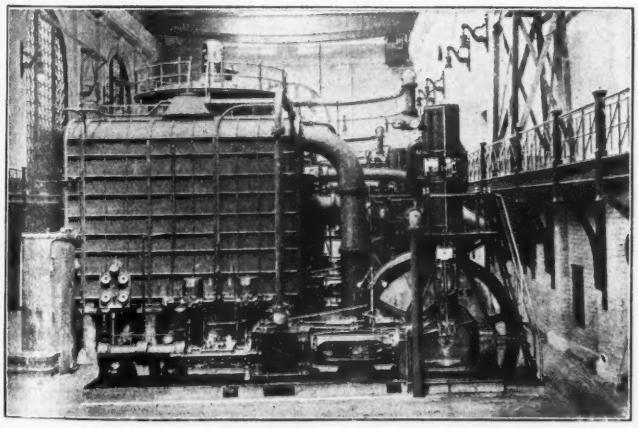
We have just started an active campaign with the intention of doubling our repair business during the coming year, and have increased our facilities accordingly. Please note that we own our own plant—do not have to pay exorbitant rent. We have unequaled shipping facilities—short distances to all the freight houses. Our shops are the largest and finest repair shops in America, equipped with electric traveling cranes and every tool and convenience for doing the best work in the quickest way. Our prices on repair work will be found surprisingly low. We want additional repair work and are willing to name business.

GREGORY ELECTRIC COMPANY, 16th and Lincoln Streets, Chicago

COMMONWEALTH EDISON CO.

ELECTRICAL POWER EQUIPMENT

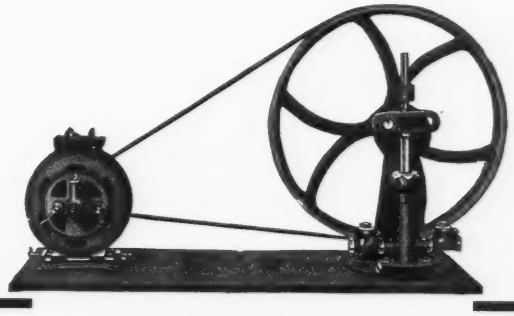
4—5,000-K. W. condensing sets, complete, with circulating, wet and dry air pumps, driven by direct-connected heavy duty Corliss engines. Now being replaced by larger units in the Commonwealth Edison Company's Fisk Street Station. Will sell complete or any part.



Corliss engines, all sizes water-tube boilers, belted generators A. C. and D. C.

Power Equipment Co.

FISHER BUILDING, CHICAGO



"Jarvis" Electric House Pumps

will pump 70, 150, 300 or 600 gallons per hour, from well or cistern. They have brass-covered plungers, and are well built in every detail. Furnished with motors, tanks and automatic controllers if desired. Write for descriptive circular and details of our proposition to Central Stations.

THE JARVIS ENGINE & MACHINE WORKS

901 River Street . . . . LANSING, MICHIGAN

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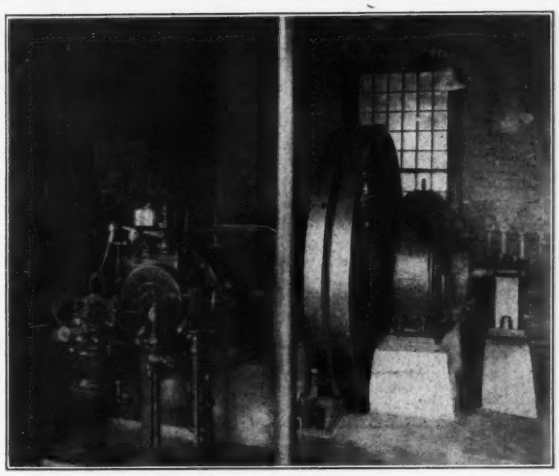

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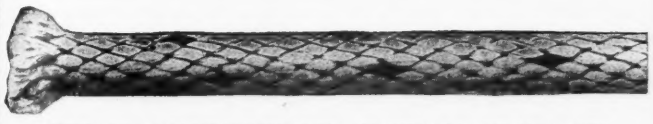

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2	½	2000	62.00
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3	¼	1165, back geared 8 to 1	60.00
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1	½	1165, new	65.00
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12	3	1165, reversible, new	139.00
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2	3½	1165	130.00
3	5	1165	170.00
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8	5	1165, variable, new	315.00
1	7½	1750, new	185.00
2	7½	1165, new	195.00
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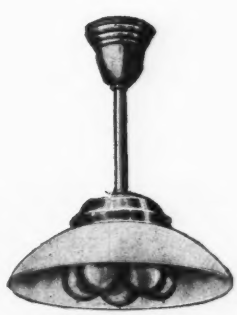

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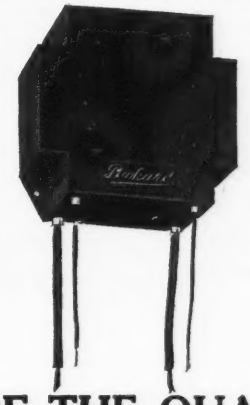

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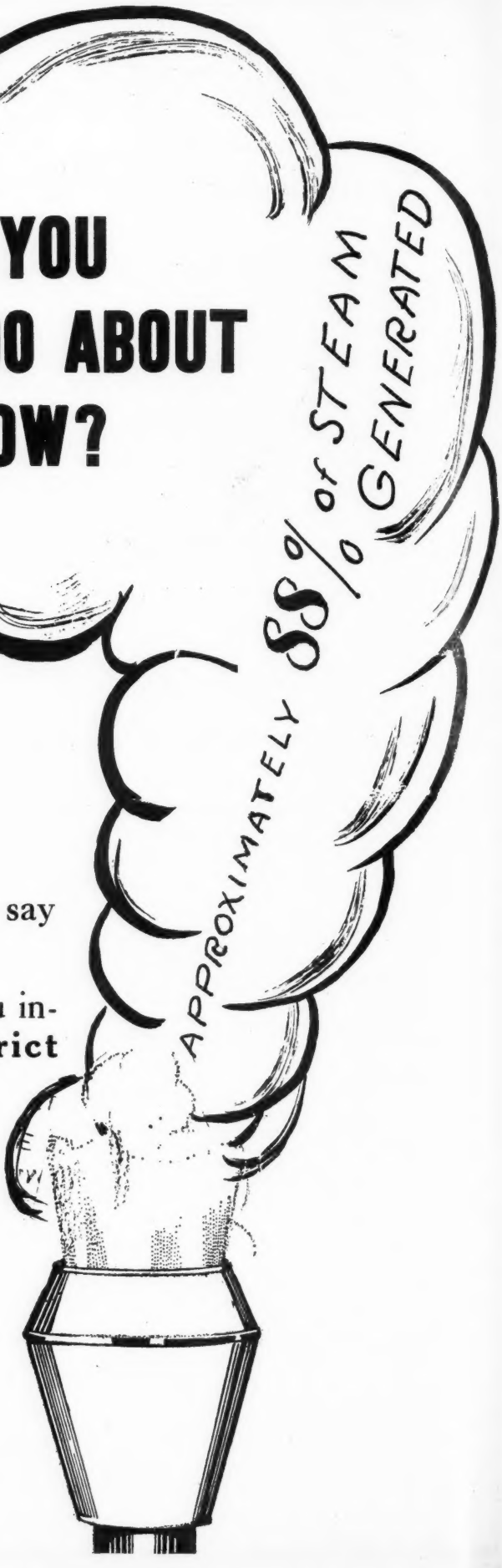

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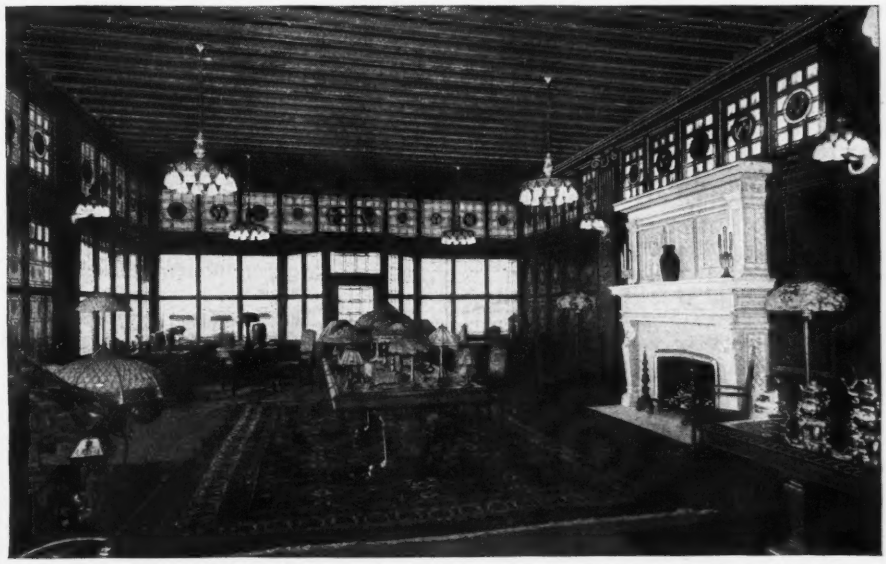

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1 1,000 H. P. Horizontal Tandem Compound Engine, built by McIntosh & Seymour; cylinder, 25″—42″ stroke. Bandwheel, 16′ diameter by 72″ face.

1 1,000 H. P. Worthington Condenser; (one condenser without tubes), otherwise in as good condition as when new. Nickel tubes.

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1 Worthington Duplex Steam Pump Plunger Pattern. Size, 9x4¾″x10, having 4″ suction and 3″ discharge. This pump has steel rods, iron plunger, brass plunger rings and hard rubber valves. This pump has a capacity of 160 gallons per minute and has been tested under steam and water in our shops.

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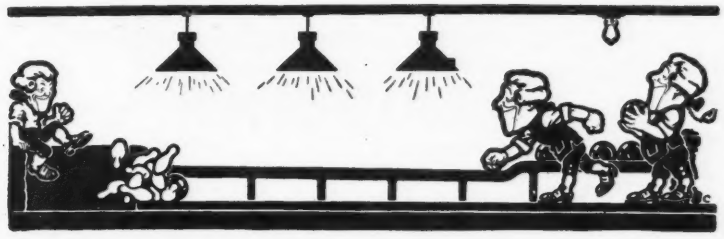

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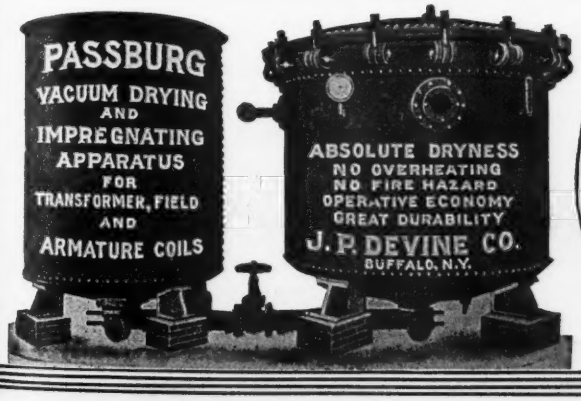

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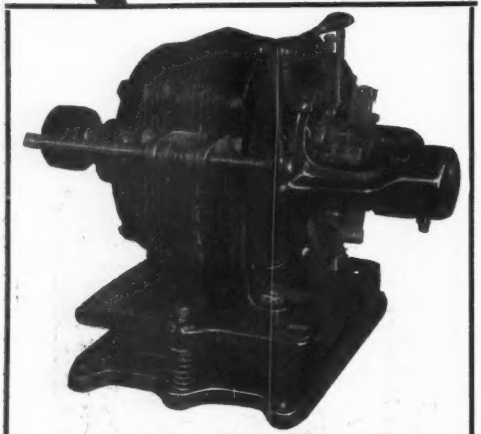

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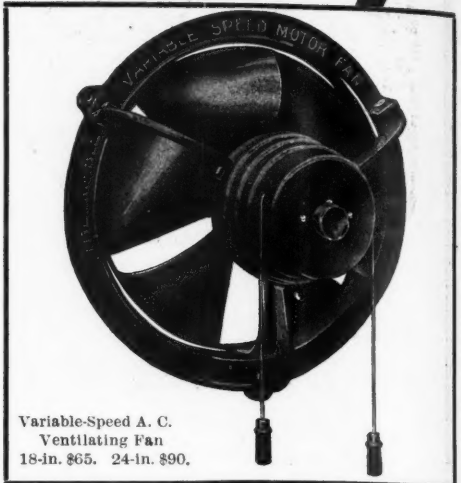

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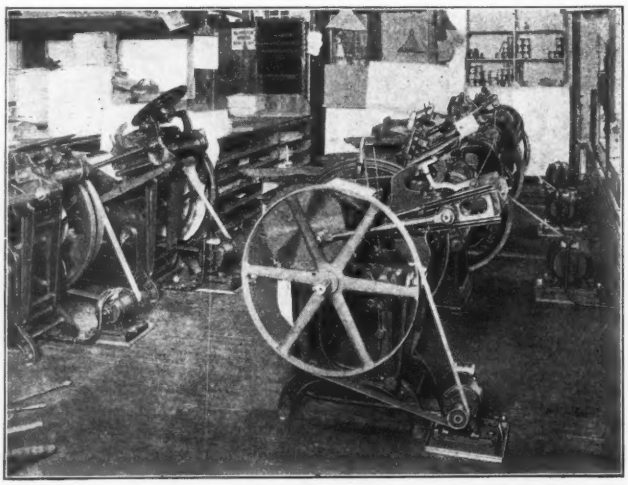

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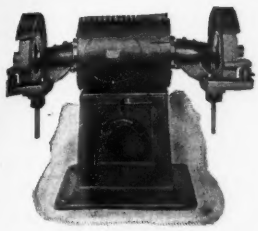

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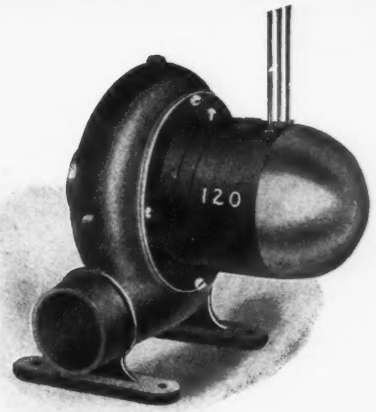

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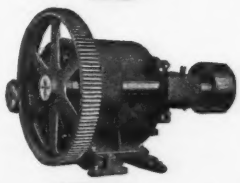

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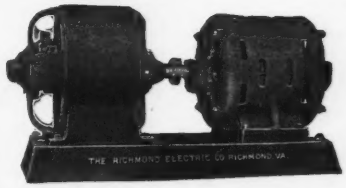

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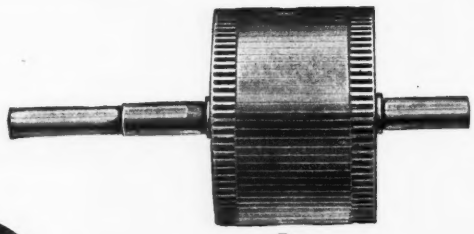
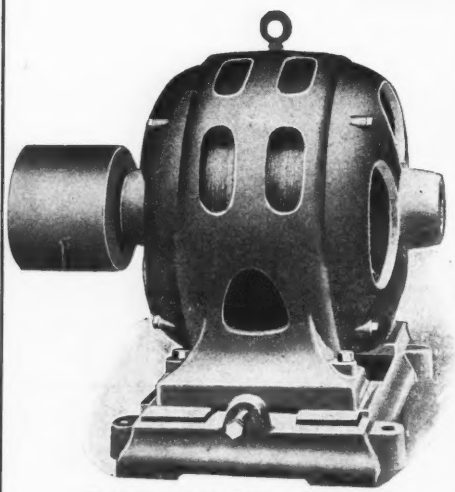


Rotor



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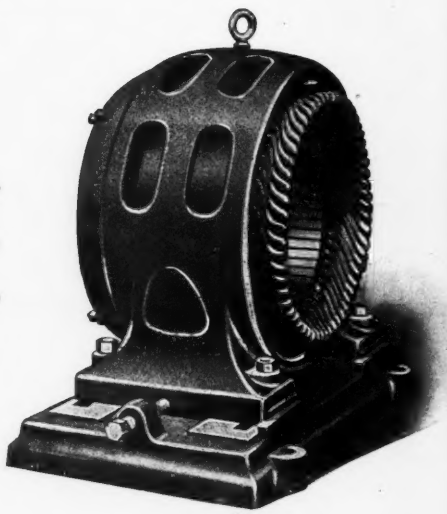

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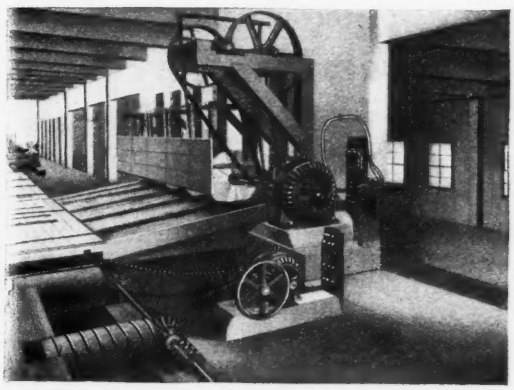
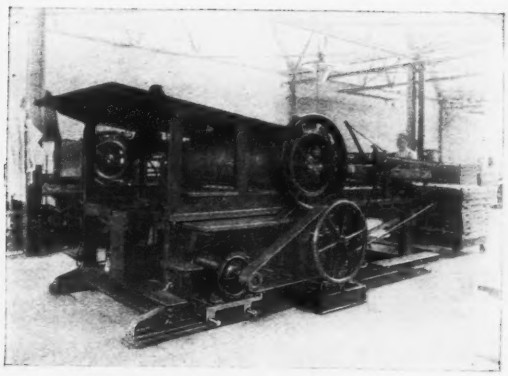


Hawthorn Alternating-Current Motors in a woodworking shop.



Hawthorn Direct-Current Motor in a printing office.

Visit us at booths 5 and 6 at the Atlantic City Convention of the National Electric Light Association, June 1-4.

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The reliability of Hawthorn Motors, their ability to carry extremely heavy overloads in emergencies is the secret of their popularity with all users.

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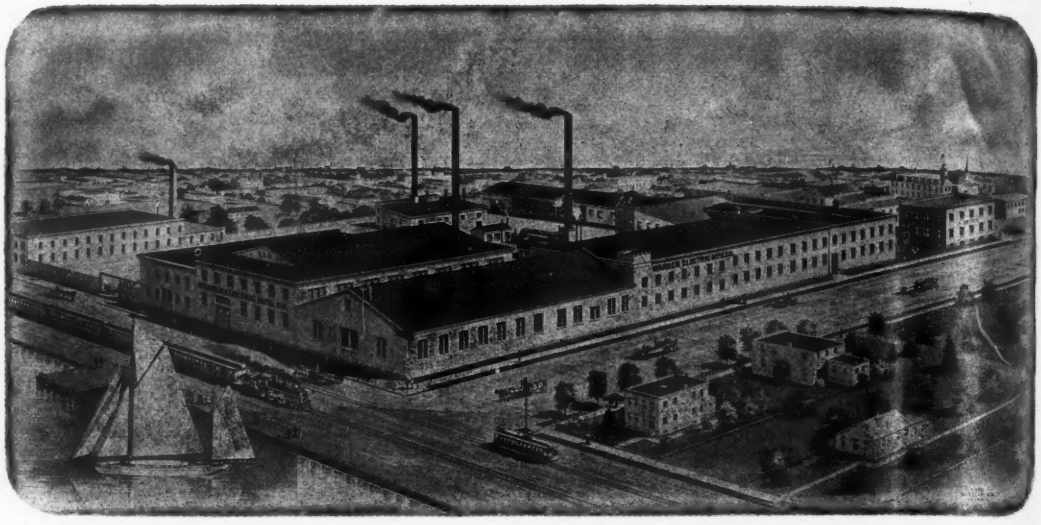

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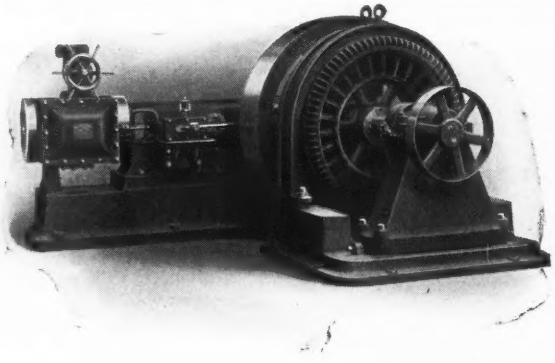

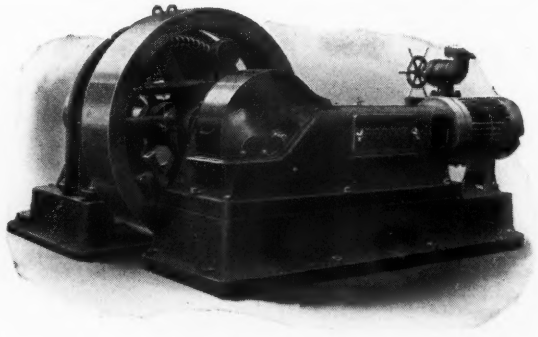

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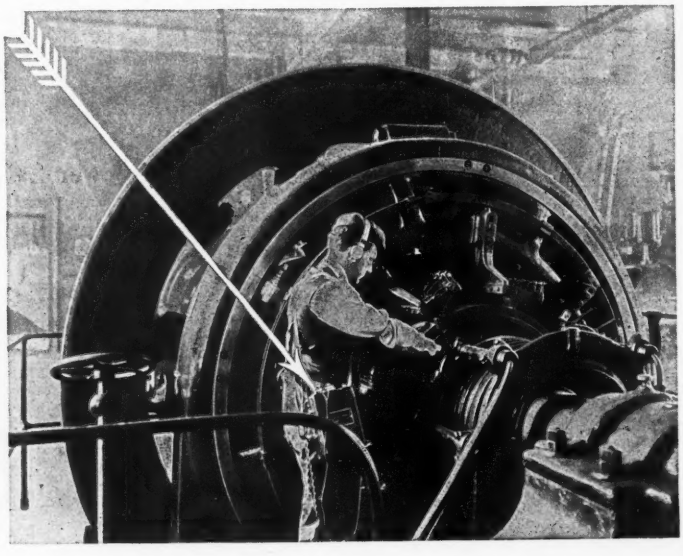

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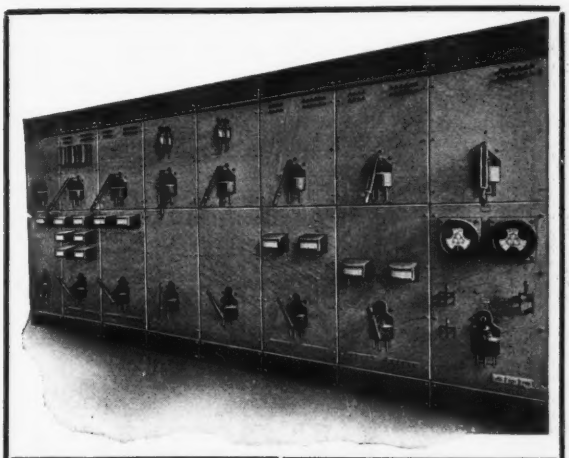

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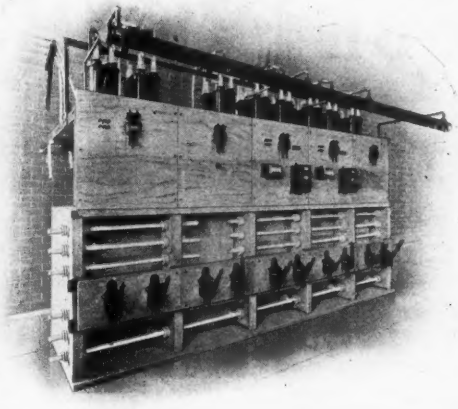

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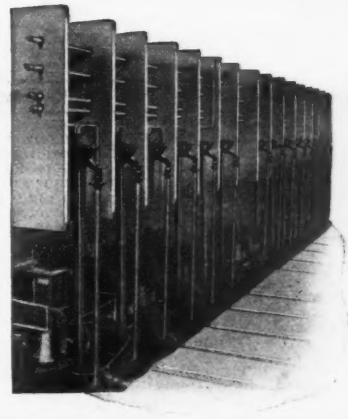

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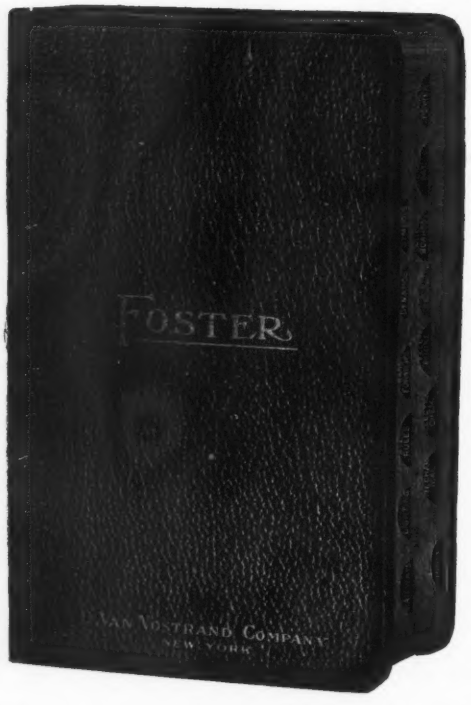

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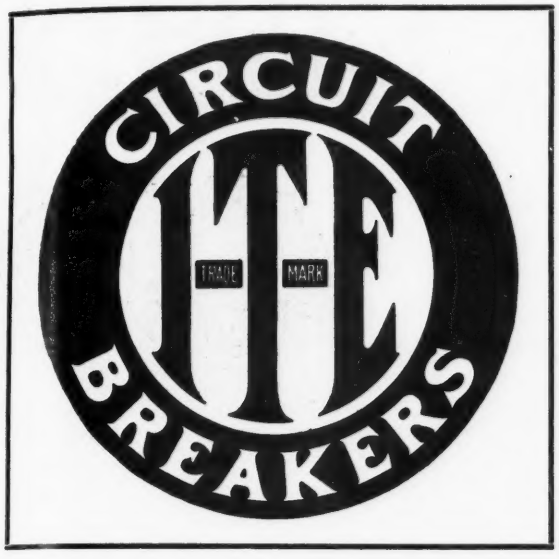

The time has gone by when "bluff," "bluster" and "brass" would pass for a circuit-breaker. It did not stand the test. Brains and copper are better. The work which a circuit-breaker is called upon to perform is usually very severe; under normal conditions it does not operate at all, but when conditions are unusual or abnormal the circuit-breaker comes into service.

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is admittedly the best piece of apparatus of its class on the market. Circuit-breakers for remote control are now in high favor, and as their economy and usefulness are better understood the demand for them will increase. Prices and details on application.

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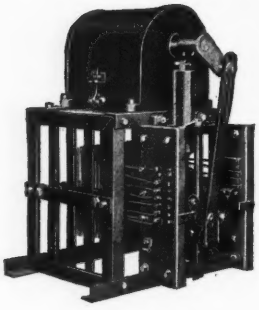
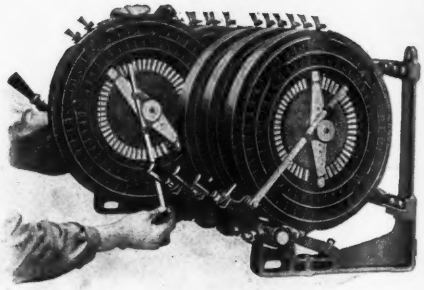
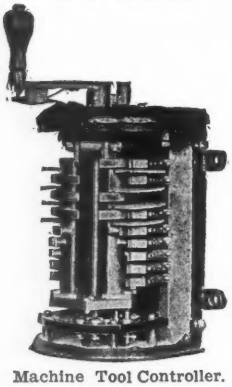




Electric Controlling Devices
FOR ALL PURPOSES



Machine Tool Controller.

Note, please, the underscored words: "For all purposes." Our standardized controlling devices now exceed 2,500 in number, but even this great array of apparatus is insufficient to meet all modern needs. As the use of electricity extends to new fields, as the desire to substitute automatic operation for manual operation increases, the demand for special apparatus becomes more insistent. This demand we are prepared to satisfy.

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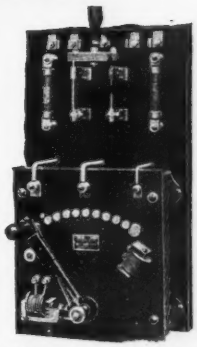

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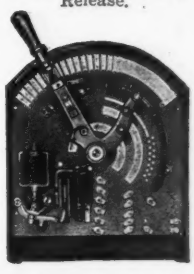
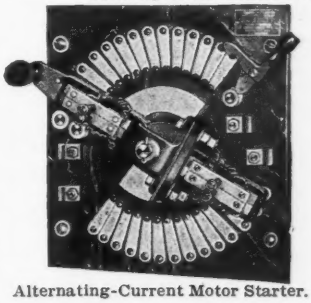


Printing-Press Controller.



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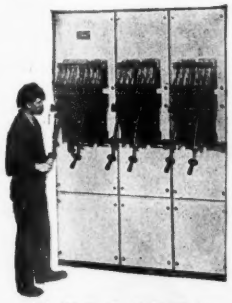

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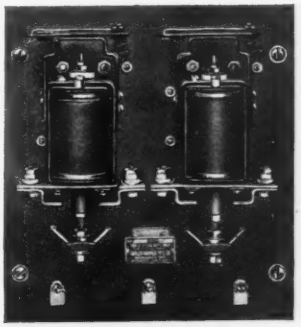
Dynamo Field Regulator.

Push-Button Lamp Socket.

Two-Circuit Pendent Switch.



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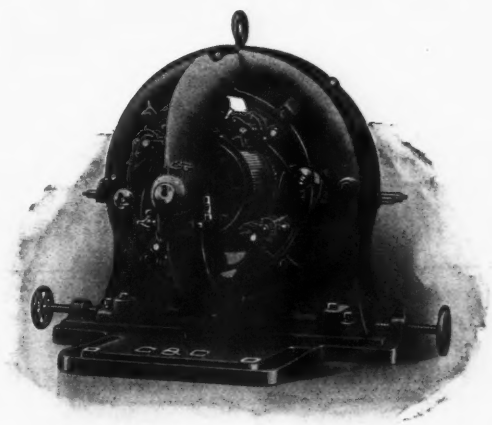

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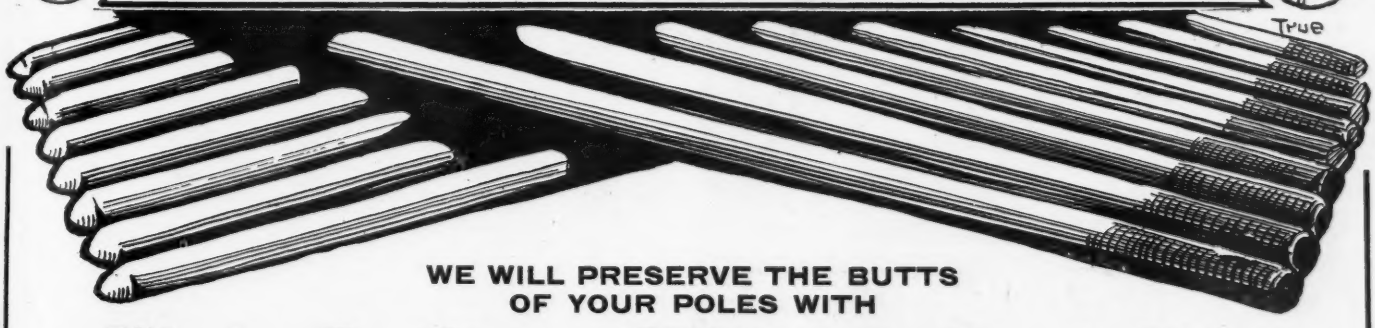

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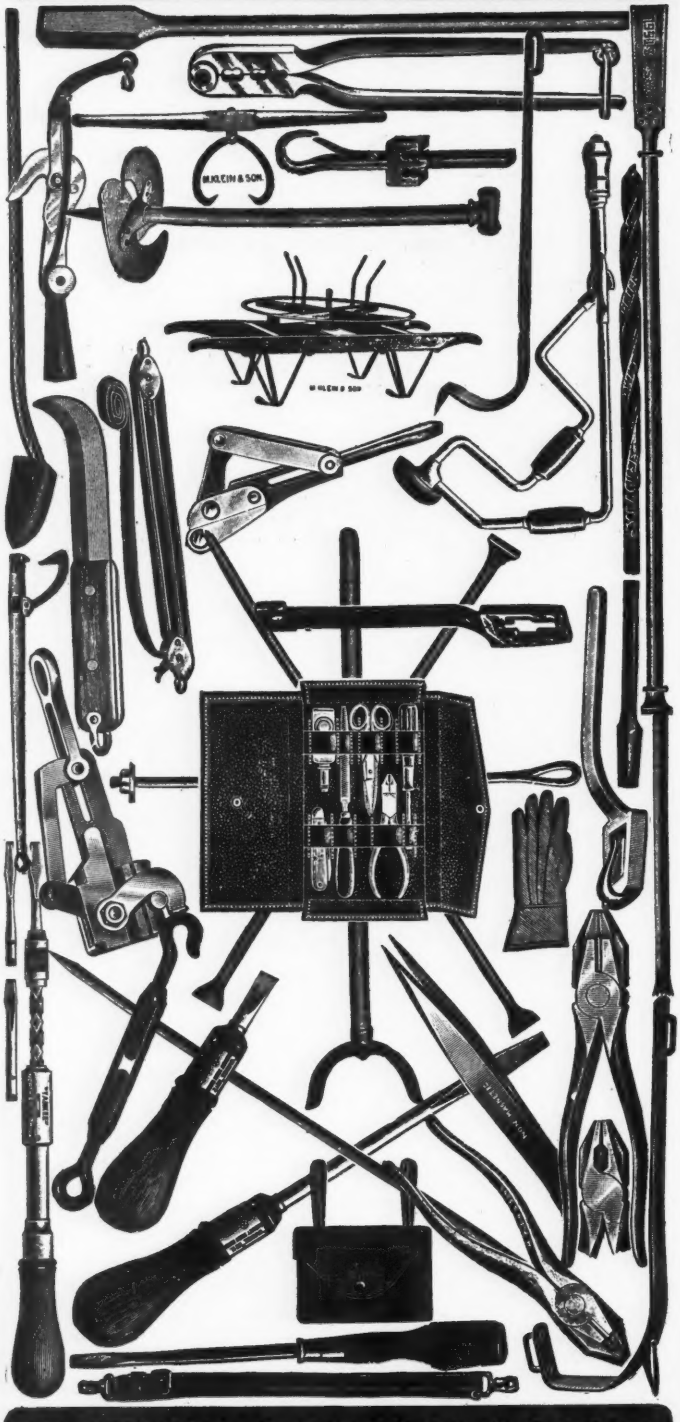

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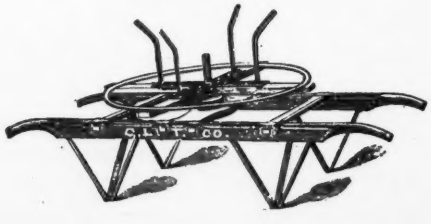

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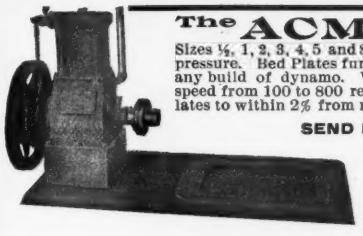

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Westinghouse

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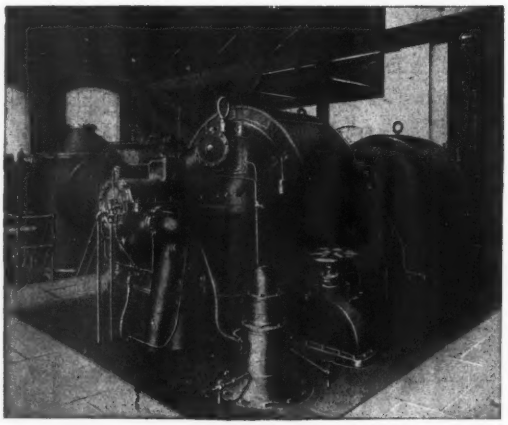

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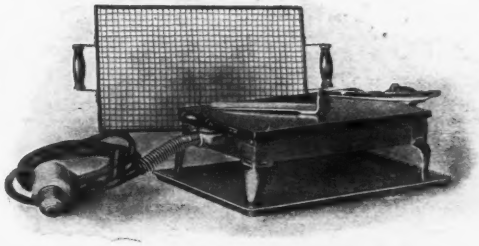

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Used as a Toaster

With Toasting Grid in Position

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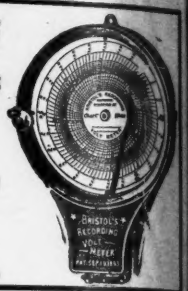

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